SUPPLEMENT.

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FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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No. 2167.—VOL. XLVII. LONDON, SATURDAY, MARCH 3, 1877. PRICE (WITH THE JOURNAL) SIXPENCE. PER ANNUM, BY POST, £1 4s.

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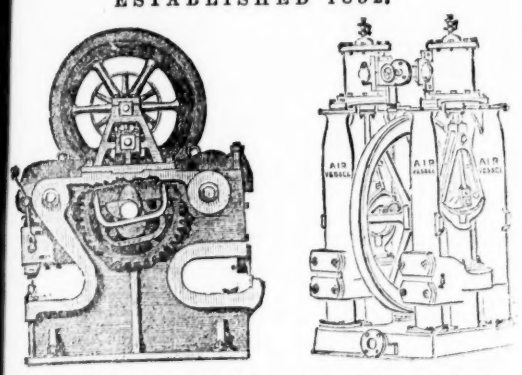

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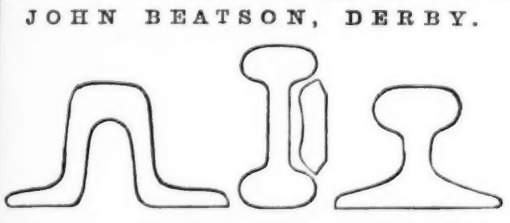

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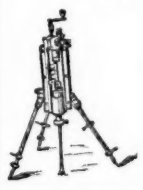

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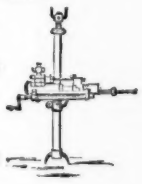

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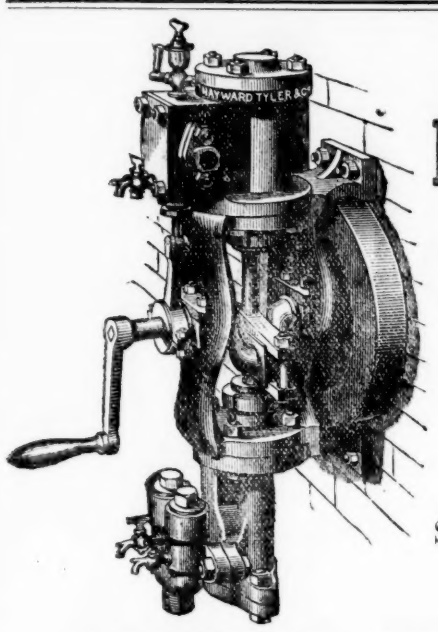

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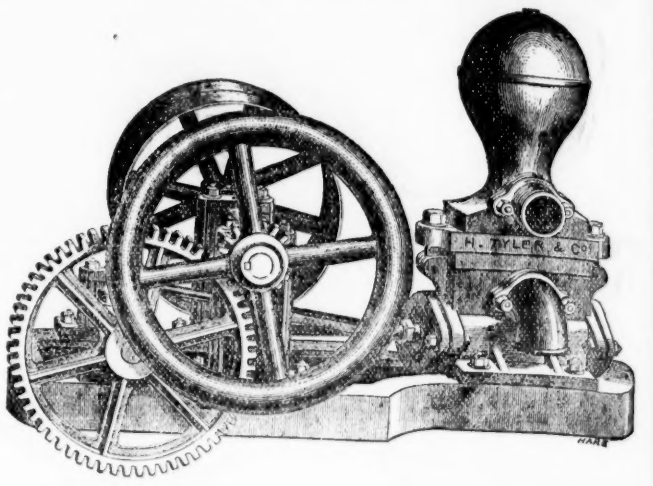

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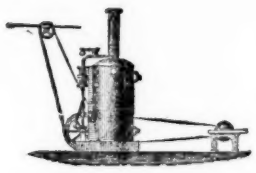

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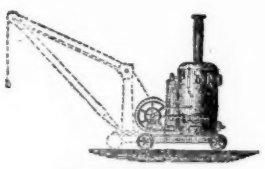

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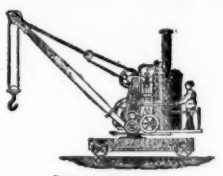

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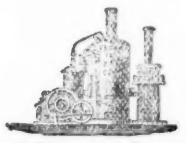

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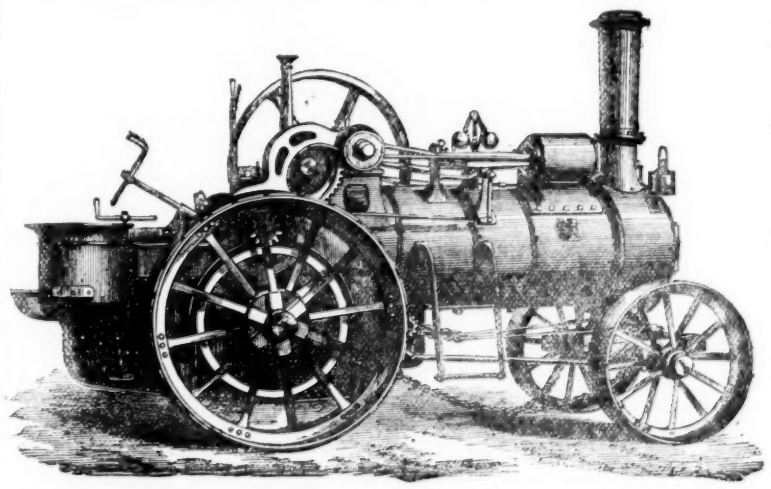

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THE IRON INDUSTRIES OF CORNWALL.

By RICHARD MEADE, Assistant Keeper of Mining Records, Museum of Practical Geology.

This most western county of England has ever been famous for the great richness and variety of her mineral treasures; the ores of tin were wrought at a very early period, and in this and the adjoining county of Devon this important ore alone occurs disseminated through its rocks. Copper ore is also abundant, and but few minerals known to the miner are absent. The ores of iron are also widely disseminated, occurring principally in the form of lodes, and traversing large tracts of country; these deposits, though long known, have been but partially developed. Borlase, writing about the year 1758, mentions the fact of iron ore being known to occur in many parts of the county, though not at that time worked; later, in the year 1788, it appears from Pryce that these lodes of iron still remained unwrought. It is known, however, that in the neighbouring county of Devon ores of iron were wrought about the year 1796 from a lode situated near Coombe Martin, in that county; and it is recorded by Lysons, in his "Mag. Britannia Devon," that 9263 tons were shipped to South Wales, to the ironworks at Llanelly, between the above-named year and 1802. The iron ore of Cornwall, as previously stated, occurs principally in lodes, many of these are known to extend for several miles in a direct course, generally these lodes have a direction a few degrees west of north, and underlying about 1 ft. in 1 fm., and containing hematite of the red or brown variety, many of the lodes being, in fact, the cross-courses of the respective districts in which they occur.

The largest deposit of iron ore in Cornwall is that worked at Restormel, near Lostwithiel, where a lode having an average thickness of from 12 to 16 ft. has long been wrought, and traced across the country for upwards of a mile. This mine was first opened by Mr. Adam Thompson, and was subsequently acquired by the Messrs. John Taylor and Sons, and worked under the name of the Restormel Royal Iron Mine. Clay-slate is the rock of the district, the dip of which is to the east, the lode here occurring has a north and south direction, dipping 1 ft. in 1 fm., and consists mainly of iron ore, quartz, and flookan; the workings of the mine are above the deep adit while the ore wrought is brought out of the mine by the same adit over tramways drawn by horses; the nearest shipping port is that of Fowey, distant some 6 miles, and situated on the river of the same name. The returns of production of brown hematite of the Restormel Mine will be seen in the annexed abstract since the year 1855:—

Year.	Tons.	Year.	Tons.	Year.	Tons.
1855	20,807	1862	2,611	1869	1,089
1856	8,229	1863	2,294	1870	Nil.
1857	7,077	1864	8,357	1871	3,954
1858	12,956	1865	6,170	1872	7,521
1859	6,915	1866	4,190	1873	4,6 9
1860	2,980	1867	1,005	1874	1,087
1861	5,519	1868	608	1875	3,510

The ore here wrought is principally a crystallised brown hematite or Gothite, occurring in fibrous and mammilated aggregates, and also in long prismatic crystals; in the upper levels of Restormel crystals of carbonate of iron altered to brown hematite are met with, while the presence of manganese in these ores render them of much value, and well adapted for the manufacture of steel and iron.

West of Bodmin, and distant some 3 miles, at Boscarne, occurs a lode partly wrought, this lode has a run of some 750 fms., with a depth of 20 fms., and an average width of 1 fm.; other lodes, known as the Nantallon lodes, occur south of Boscarne, these are three in number, running with little variation north and south, and a slight underlie; two of these lodes have a range of nearly 1750 fms., while the third has a range of 2200 fms.; the average depth of these lodes does not exceed 20 fms., while in width one is ½ fm., and the remaining two are 1 fm. each in width. The ore wrought at Nantallon is of the variety known as "fibrous kidney ore," the iron existing in the form of hydrated peroxide.

Red hematite of an irregular structure and associated with quartz, the iron occurring as anhydrous peroxide, has been wrought at Tregorne to the west of Mulberry Hill, the lode having a range of some 500 fms., 30 fms. in depth, and with an average width of 3 ft. Other lodes of importance occur to the west and south of Bodmin; at Tremoor two lodes, extending some 2000 yards, 15 fms. deep, and an average width of 1 yard. Again, at Withiel, Retire, and at Coldvreath and Trerank. The Coldvreath lodes have been worked to some extent, their direction extending 800 fms. north and south, 16 fms. in depth, and having an average width exceeding 2 yards. The ore raised at Coldvreath is known as compact red hematite, a small portion being distinguished as "kidney ore." The following abstract will show the production of iron ore in the districts above referred to, from which it will be seen that the mines have not been wrought for any lengthened period:—

RETIRE.		COLDVREATH.		LANIVET.	
Year.	Tons.	Year.	Tons.	Year.	Tons.
1856	1121	1858	890	1867	408
1857	1075	1859	2294	1871	1827
1858	2988	1860	546	1872	6132
1860	600	1861	561	1873	2200
1861	2564	1864	289	CARNEWAS.	
1862	2188	1865	305	1868	1256
1863	1977	1870	1116	1869	1942
1864	2146	1871	194	1870	2341
1865	3144			1874	486
1866	2640	TREBANK.		BLACKHAY.	
1867	2641	1866	124	1872	720
1869	588	1867	540	1873	585
1870	350	1868	509	1874	800

In the district of St. Columb numerous lodes occur, the principal being those known as Indian Queens and Trelivier; the former was opened out about the year 1866, and as far as can be ascertained the following shows the quantities of hematite raised between the years 1856 and 1863:—

Year.	Tons.	Year.	Tons.	Year.	Tons.
1856	5097	1859	3021	1862	1750
1857	506	1860	4946	1863	473
1858	1739	1861	234		

North and south of St. Columb red hematite has been wrought in numerous places, the more important being Knightor and Ruby, situated near St. Austell, and the Pawton Iron Mine, near St. Breock's, some 5 miles from Padstow and 3 miles from Wadebridge. The lode in which the hematite occurs occupies a distinct fissure in the killas or clay-slate, its direction being nearly north and south. The ore wrought in the upper part of the mine is red hematite, except close to the surface, where some of it appears to be a brown hematite; in the lower levels the hematite is found intermixed with spathose carbonate. The workings in the Pawton Mine extend some 150 fms. in length on the lode; they have, however, been but partially developed, while the greatest depth to which they have been carried does not exceed 33 fms.

The following statement gives the quantities of ore raised at Pawton and other mines in the surrounding districts:—

PAWTON.		KNIGHTOR AND RUBY.		LADOCK.	
Year.	Tons.	Year.	Tons.	Year.	Tons.
1859	1182	1863	2000	1860	1254
1862	9876	1864	7925	1862	762
1863	7618	1865	6545	1863	2413
1864	7848	1866	7951	1864	1177
1865	9626	1868	5937	1872	844
1873	1000	1870	5406	1873	512
1874	4372	1871	9154	1874	250

The lode at Ladock yields an ore of good quality of hard brown hematite, from 10 to 12 feet wide, embedded in a very supporting light-brown killas, from which lode 200 tons were raised in 1875.

There is another important deposit of iron ore to refer to—that of the great Perran iron lode. This lode is seen on the northern coast of Cornwall, at Perran Bay, where it attains a width of nearly 100 ft., consisting of two branches, divided by a "horse" of killas or clay-slate; it has a range of many miles. The most productive part hitherto explored is that extending to Deer Park, a distance of some 4 miles from the coast, in a direction south-east; it appears to have been traced to the neighbourhood of Grampound, but this latter portion of the lode does not give evidence of great productiveness. The lode contains hematite, specular and earthy brown ore, quartz, and slate. It does not, however, appear to have been more than partially wrought; the first workings were made by Mr. S. Hockaday, now of St. Austell, the ore being quarried near the cliff, and conveyed a distance of 6 miles to Newquay by carts, where it was shipped to the ironworks of South Wales; the cost of carriage, however, operated greatly against the extension of this industry. This will be better understood by the fact that previous to the year 1865 a contract was entered into between the Dowlais Company and a mine proprietor for the supply of 40,000 tons of ore; the contract was fulfilled, but the difficulties of transport, however, prevented a renewal of the contract, which was much to be regretted, as the ore when reduced to the metallic state gave most satisfactory results. In recent years much activity has been exhibited in opening out the deposits on the great Perran iron lode, which will be seen by the following returns of some of the principal mines worked on the above-named lode, which lode has been proved to extend in depth some 25 fms., and has an average width of nearly 3 fms.:—

DUCHY AND PERU.		TREBISKEN AND MOUNT.		TREAMBLE.	
Year.	Tons.	Year.	Tons.	Year.	Tons.
1858	2762	1864	2876	1859	2391
1859	1995	1865	6193	1860	1312
1860	4895	1866	1234	1864	222
1862	169	1871	1435	1873	426
1863	3950	1872	8293	1874	9438
1864	2366	1873	2464		
1865	3539	1874	2545	GREAT RETALLACK.	
1866	150			1858	4017
1873	528	GRAVEL HILL.		1859	6609
1874	2566	1874	2505		
1875	412	1875	494		

Many other localities in Cornwall are known to yield ore of good quality, and there can be no doubt that whenever occasion arises, by the revival of our iron industries, Cornwall can furnish considerable quantities of rich ore to meet any such demands. The district of Constantine, to the east of Falmouth, has some lodes of iron wrought in recent years, one of these varies from 6 ft. to 6 in. in width, and has produced the following quantities of ore in each of the years named:—

Year.	Tons.	Year.	Tons.	Year.	Tons.
1866	150	1871	881	1874	1060
1669	1000	1872	2241	1875	1276
1870	1000	1873	2000		

With the foregoing sketch of the principal iron ore deposits of Cornwall, and the returns of individual mines as far as obtainable, it will be desirable to show the aggregate production of ore of all kinds, since the year 1855, raised from the iron mines of Cornwall:—

Year.	Tons.	Year.	Tons.	Year.	Tons.
1855	24,057	1862	24,626	1869	4,619
1856	22,650	1863	18,975	1870	11,214
1857	19,359	1864	34,210	1871	21,947
1858	55,150	1865	36,112	1872	48,199
1859	35,213	1866	18,683	1873	31,455
1860	23,953	1867	6,424	1874	45,055
1861	26,262	1868	8,310	1875	11,403

In the year 1875 the total output of the Cornish mines amounted to 11,403 tons, of the value of 6891*l.*; these figures show a great falling off compared with the year 1874, while as regards the output of the mines of the United Kingdom in the year 1875 a great increase appears, the produce being 15,821,060 tons of iron ore of all kinds of the value of 5,975,410*l.*, compared with 14,844,936 tons of the value of 7,313,146*l.* in the year 1874. To the above quantities in the year 1875 must be added the "burnt ore" obtained from cupreous pyrites, which amounted to 280,000 tons, and the ores imported from foreign countries, furnishing a further quantity of 458,693 tons, giving an aggregate of 16,559,753 tons of ore of all kinds smelted in the iron furnaces of the United Kingdom. The burnt ores, it will be remembered, though inconsiderable in quantity, yet are extremely rich in metallic iron, yielding from 62 to 67 per cent., while the foreign ore, the great bulk of which is derived from the mines of Spain, yield from 50 to 60 per cent. of metallic iron. In the annexed statement will be found the mines in operation in Cornwall in each of the years 1874 and 1875, as far as returns have been published:—

Names of Iron Mines.	Character of Ore.	1874. Tons.	1875. Tons.
Blackhay, Withiel	Brown hematite	1000	—
Carnewis	Ditto	486	—
Colbiggen, Roche	Ditto	4031	—
Colvreath, St. Austell	Ditto	440	328
Constantine, Constantine	Ditto	1060	1276
Deer Park, Perran	Ditto	—	40
Duchy and Peru, Perran	Spathose and hematite	2566	412
Gravel Hill, Perran	Ditto	2505	494
Great Down	Ditto	300	—
Grenville, East Huel	Ditto	1073	—
Knightor and Treverbyn	Brown hematite	350	—
Ladock, Ladock	Ditto	250	200
Lanivet, Lanivet	Ditto	1?4	2089
Mount and Trebisken, Perran	Spathose and hematite	2545	374
Old Treburgett, St. Teath	Ditto	—	62
Mills, New, Ladock	Brown hematite	92	—
Pawton, St. Breock	Ditto	4372	—
Restinnis and Treffrey, St. Blazey	Ditto	372	1060
Restormel, Lostwithiel	Ditto	1087	3510
Rudy and Tregurthy	Ditto	628?	—
St. Stephen's, St. Austell	Ditto	4?0	—
Terras, South, Grampound	Ditto	4 0	—
Treamble, Perran	Spathose and hematite	9438	958
Trebarvah, Perran	Brown hematite	849	—
Treganetha, St. Wenn	Ditto	413	600
Tretoil, Bodmin	Ditto	275	—
West Downs	Ditto	104	—
Mid Cornwall Mines	Ditto	1655	—
Total		45,055	11,403

The value of the ore in the year 1874 amounted to 32,825*l.*, and in 1875 to 6891*l.*, the average value per ton of ore in 1875 being about 12s., and in 1874 not less than 15s.

DISTRIBUTION OF THE CORNISH IRON ORES.—Rich hematite and spathose ores are in great and increasing demand for the economical production of iron, either when used alone or in admixture with poorer ores. The Cornish ores find a ready market in the iron districts of South Wales and the North of England, whence they are shipped by colliers taking return freights to those districts. The principal ports of shipment are Padstow, Newquay, and St. Agnes on the north coast, and Truro and Fowey on the south. In the following statements will be seen the quantities of ore shipped in each of the years, as far as such returns are obtainable:—

ST. AGNES.		Year.	Tons.	Year.	Tons.
Year.	Tons.	TRURO.		1866	4350
1865	4400	1865	1700	1867	468
1866	1970	1866	2637	1868	1256
1871	526	1871	3500	1869	1200
1872	2234	1872	7200	1870	933
1873	2027	PADSTOW.		1871	2132
1874	118	1859	8806	1872	6132
1875	196	1861	8209	1873	6486
		1864	7618	1874	6406
		1865	9626	1875	2089

ANALYSES OF THE CORNISH ORES.—From a large collection of analyses the following have been selected, as showing generally fair average examples of the constituents of the ore raised in the Perran district from the Treamble Mine, where three varieties of ore are raised. The following shows their respective composition:—

	Brown hematite.	Kidney ore.	White spathose.
Silica	4·20	10·00	1·74
Peroxide of iron	69·10	78·10	—
Peroxide of manganese	14·00	trace	8·13
Protoxide of iron	—	trace	51·61
Lime	·80	trace	1·51
Magnesia	—	—	·36
Alumina	—	trace	—
Sulphuric acid	—	—	·15
Phosphoric acid	·24	1·44	trace
Carbonic acid	—	—	35·55
Water	11·60	10·00	—
Total	99·94	99·54	99·05

An average of five samples of the two first-named varieties gives 75·28 per cent. of the peroxide of iron and manganese, equivalent to 53 per cent. of metallic iron. The above analyses were made respectively by Dr. Noad, Mr. J. H. Collins, public analyst to the county of Cornwall, and the Wigan Coal and Iron Company.

The red hematite raised from the Knightor and Treverbyn lodes (east, west, and new), in the district of St. Austell, examined by Mr. Edmund G. Tosh, show the following constituents:—

KNIGHTOR AND TREVERBYN ORES.	East lode.	West lode.	New lode.
Ferric oxide	94·62	83·29	84·85
Manganese oxide	0·11	0·08	trace
Alumina	0·27	0·55	0·50
Lime	0·09	0·14	0·09
Magnesia	0·03	0·08	0·02
Phosphoric acid	0·01	0·02	0·02
Sulphur	trace	0·02	trace
Siliceous matter	3·39	14·46	11·79
Water and carbonic acid	0·69	1·19	2·34
Total	99·21	99·83	99·61
Metallic iron	66·23	58·30	59·40

These ores may be taken for purity and richness as equal to the best of this district. Other analyses of the ore from the same mine give of metallic iron 58·01 and 51·20 per cent.

The mines of St. Austell yield ore of brown hematite, and they are found comparatively free from sulphur and phosphoric acid—a fact of much importance to the ironmaster. In the annexed analyses will be seen the composition of the brown hematite raised at Kernick and Bodennick Mines, in the parish of St. Stephen's, near St. Austell:

	Dr. Noad.	Dr. Noad.	Dr. Perkins.
Peroxide of iron	76·00	79·56	80·20
Oxide of manganese	3·20	1·20	2·01
Lime	1·00	1·20	·14
Magnesia	—	0·53	—
Phosphoric acid	·30	·28	—
Silicate of alumina	10·00	7·20	—
Silica	—	—	15·50
Water	9·50	10·00	2·06
Total	100·00	99·97	100·00
Yield of metallic iron	53·20	55·60	56·17

The red hematite deposit in the Pawton Mine, near Wadebridge, is found in the lower levels, intermixed with spathose carbonate. Mr. J. H. Collins, who has examined this ore, observes that "at all depths much of the ore has been of the botryoidal or kidney form, and generally very free from silica, sulphur, and phosphorus," and gives the following results, that side by side is an analysis of ore from a lower level:—

Peroxide of iron	93·00	65·00
Carbonate of iron	—	26·10
Carbonic acid and moisture	2·50	1·20
Silica, chiefly quartz	3·60	4·40
Sulphur	trace	·20
Phosphorus	trace	trace
Alumina and lime	1·10	1·80
Manganese	—	1·00
Total	100·20	99·70

The foregoing analyses show clearly the rich character of the Cornish ores, from which it appears they have scarcely received the attention they deserve. Whenever the demand may arise Cornwall in the development of her ferruginous deposits can largely supplement the resources of our iron making districts, and expand an important industry in the interests of that western county.

OUTLINES OF GEOLOGY—No. IV.

THE SECONDARY, OR MESOZOIC SYSTEM.

SIR,—This comprises the Triassic, Oolitic, and Cretaceous formations. The primary period ends with the Permian formation, as described in last letter, having fossil animals analogous to those of the Carboniferous era preceding. The secondary strata have throughout the remains of higher forms of animals than are found in the primary—not only reptiles, but birds and mammalia then inhabited the earth. The geologist not only studies the successive formations of rocks, how they were formed and altered, he also gains an insight into the kind of animals living on the earth, or in the waters, at these successive periods, and notes the gradual rise in the scale of organic life. The Triassic system is composed of three members—

3. The Keuper.
2. The Muschelkalk.
1. The Bunter Sandstone.

These are all found in Germany, of an aggregate thickness of 3000 ft., in Britain the Muschelkalk is wanting. The Bunter is composed of red and mottled sandstones, and pebble beds, about 1200 feet. The Keuper consists of sandstones, having divisions of red marl (called water-stones) at their base, and red marls above the sandstones, from which rock salt is obtained in the neighbourhood of Northwich, in Cheshire, and at Droitwich, the Keuper series being also about 1200 ft. in thickness. It is important to point out here the general opinion of learned men in this science that previous to the Triassic period the primary rocks had been subject to vast denudation, so that it is not always safe to reckon on the ordinary sequence of strata below the trias, the latter usually lying unconformably on the primary rocks. In the trias are found brachiopods, bivalve and univalve shell-fish, cephalopods, encrinites, fish, reptiles, traces of birds, and mammals. The cephalopods, as ammonites, belemnites, &c., come into play; the fish are nearly all found in the bone bed, which is a part of the Rhaetic or passage beds, between the trias and the lias. The footprints of birds have been found in great quantity in certain sandstones in North America, these rocks being supposed to be contemporaneous with our Keuper beds. Teeth of mammalia have been found also in the Keuper, supposed to be those of a small marsupial animal.

The *Oolitic* formation comprises the following—

11. Purbeck beds, fresh-water deposits.
10. Portland beds.
9. Kimmeridge clay.
8. Coraline oolite.
7. Oxford clay and cornbrash.
6. Great oolite.
5. Fuller's earth.
4. Inferior oolite.
3. Upper lias.
2. Marlstone, or middle lias.
1. Lower lias.

} These are principally marine deposits, excepting the coal beds of the lower oolite.

The aggregate thickness of the lias and oolites, supposing they were all developed, would be about 3000 ft., the lias alone being 1100 ft.; the Oxford clay and Kimmeridge clay being the other two chief members of the system.

The lias is remarkable in its abundance of fossils. The blue clays of the lower lias, with hard limestone bands at the bottom, are well seen at Redcar, in Yorkshire, and with the middle and upper lias occur from thence to Whitby. The Liassic period has been called the age of reptiles, in the lias are found the remarkable reptilian remains of great size, called ichthyosaurus, plesiosaurus, and teleosaurus. The remains of foraminifera, brachiopods, bivalve and univalve shell fish, and cepnalopods, also abound. The cephalopods comprise a great number of species of ammonites and belemnites, as Ammonites communis, A, bifrons, A. costatus, &c., in fact, most of the species have lived each in its own zone in the lias. From the middle lias is obtained the ironstone now so extensively worked in Cleveland, its ordinary thickness being 7 to 8 ft., yielding about 33 per cent. of metallic iron. The remains of pectens, brachiopoda, and belemnites abound in this ironstone, fossil wood is also found, but plant remains are rare in the lias. The oolites proper are divided into lower, middle, and upper oolite, consisting, as the above table indicates, of oolitic or roe-like sandstones and limestones, and indurated clays. Coal is found and partially worked in the lower oolite of Yorkshire. The great oolite formation contains the Stonesfield slate, remarkable as a deposit for terrestrial reptiles and mammalian remains. The coralline oolite is remarkable as a deposit, made up in some of its beds of coral remains. The Kimmeridge clay is developed in Dorset, Wiltshire, and again in Lincoln and Yorkshire. In Dorset, some of its beds pass into bituminous shale, and sometimes into brown slaty coal. The oolitic strata are very variable lithologically, the sandstones passing into oolitic limestones. As a system they are largely developed in England, but little in Scotland and Ireland; the several beds are not continuous over large areas even in England, indicating a frequent change of sea and land, or rather of hills and valleys, during the oolitic period. This system is largely developed on the Continent, and known there as the Jurassic series, the Jura mountains being formed of them. The area of the Jura may be five or six times that of the oolite in England.

In the Jura mountains the strata are wonderfully contorted and folded. The Jurassic strata become in the Swiss Alps completely metamorphosed, giving them very much the appearance of primary metamorphic rocks. From these notable features of the Jura group we perceive the results of volcanic energy much greater than is found in England at least. Oolitic rocks have been identified in North America. In India, Australia, and the Arctic regions ammonites have been found in rocks corresponding closely with portions of our oolitic formation.

The animal life of this period is exhibited by remains of brachiopods, conchifera, and gasteropods, cephalopoda, and echinodermata, with some fish, reptile, and mammalian remains. Take some of the cephalopoda of the Oxford clay, Ammonite calloviensis, A. cordatus, A. excavatus, A. Jason, A. Lamberti, A. sublevis, we shall not find the same species in the other formations of the oolitic system above and below the Oxford clay, indicating the gradual deposition of rocks and change in the species and forms of life. The plant remains, chiefly in the lower oolite, consist of equisetums, otopteris, sagenopteris, cyclopteris, pecopteris, sphenopteris, &c.; the latter being found in different species in the true coal measures. The bivalve shell-fish existed in great numbers in the lias and oolite; many of the genera have become extinct, but some now exist in our seas of different species. The principal fossil bivalves of the lias and oolites are—gryphæa incurva, cardinia listeri, avicula, hippopodium, lima, modiola, Astarte, gresslya, pecten, pholadomya, trigonia, isocardia, otæa, cardium, &c.

The cretaceous system comprises—

6. Chalk, with flints.
5. Chalk, without flints.
4. Upper greensand.
3. Gault.
2. Lower greensand.
1. Wealden series.

The thickness of these beds may be taken at 3000 ft. The chalk, the most persistent member of the system, being about 1500 ft. The fossils of the Purbeck beds in the oolite, and of the Wealden and the lower greensand, are all fresh-water animals. The Wealden rocks are divided into the Wealden clay and Hastings sand, these are, however, interstratified with each other. The area of the Wealden and the three beds above it is of limited extent, occurring in the south-east of England. It contains many plants, amongst them some of the genera found in the coal measures, also bivalve and univalve shell-fish, and a few fish and reptiles. The lower greensand contains fossils of marine animals, as brachiopods, bivalves and univalves, cephalopoda, and echinodermata. The Gault clay is used for making bricks; this and the upper greensand are marine deposits, characteristic fossils are found in each, differing in genera from each other, and from most of those found in the lower greensand. The chalk commences with chalk marl, then chalk, and chalk with flints; there is rarely any extraneous matter mixed with the chalk besides the flints. The fossils are numerous, a few of these being common to the Gault, upper greensand, and chalk. The principal fossils found in the chalk are sponges, foraminifera, polyzoa, brachiopods, bivalves and univalves, cephalopoda, echinodermata, fish, and reptiles. Some of these fossils are peculiar to the lower chalk, and some to the upper. The chalk series is found in a great part of Western Europe, and in Canada some rocks containing coal bear chalk fossils; for the same reason strata in the Andes of South America and in India are considered to belong to the cretaceous system. No mammalian remains have been found in the system. The carboniferous rocks must have been subject to considerable elevation in Belgium and the North of France, as the chalk there rests on the coal measures. The same thing is observed at Kentish Town and at Calais, where borings through the chalk pass into primary rocks.—*Feb.* 21. M. B. G.

OUTLINES OF GEOLOGY.

SIR,—In reply to your correspondent's, "J. B." letter, in the Supplement to last week's Journal, I had information that anthracite was found in the Laxey Mine, Isle of Man. I suggested this might be graphite, as it occurred in the Silurian formation. I have not been in the Isle of Man, and cannot, therefore, speak as to the extent or character of the mineral.—*Feb.* 28. M. B. G.

HYDRAULIC MINING.

SIR,—Although hydraulic mining has in many cases proved temporarily remunerative, it is scarcely possible to refer to an instance in which the shareholders have got back the money originally invested in it. In Anglo-American companies there is no instance, though the Sweetland Creek has come near to it, as through the excellent management of the executive the fortunate shareholders have received back 3*l.* 8*s.* for each 4*l.* subscribed, so that their total loss has been but 15 per cent., exclusive of the loss of interest on the 4*l.* during the company's existence. If all hydraulic and other Anglo-American enterprises could show an equally satisfactory result shareholders would have little to complain of, as the investment would then compare favourably with the investments in foreign bonds. But if hydraulic mining can only be carried on at a loss of 20 per cent. to the shareholders engaged in it when the gravel is above the surface, what must be the result when the gravel has to be raised, and especially when hydraulic force is to be used to raise it. As hydraulic mining involves loss in every case, and is damaging the water-courses and adjoining property to an irremediable extent, it is astonishing that the United States Legislature does not at once forbid it, and particularly so where from the properties being held by or for English companies, or other aliens, there would be no difficulty in effecting the necessary ejectment. It was a great mistake, both for English capitalists and for American interests, when English companies were formed for working American mines, and I opine that the English capitalist is safer in holding shares in a *bona fide* American company than in an alien company attempting to carry on business in America. The American does not object to British capital being employed for developing his mines, but does object to its being supposed that he receives purchase-money and working capital which never leaves England, and is distributed among English promoters and English directors and mine officers, who care nothing for the reputation of American industrial interests, and less for the capitalists who have embarked their money.

But to return to hydraulic mining, I would raise a warning voice against deep hydraulic workings whatever contrivances may be proposed for carrying them on. From time to time inventions are being patented for deep hydraulic working, and quite recently an apparatus has been designed by Mr. G. W. Cranston, of San Francisco, but I suppose his arrangement is mechanically bad in principle, and, therefore, will speedily sink into the same oblivion which has covered its predecessors. He first excavates at some place on the surface of the gravel bed a depression in which to locate the machine, so a sluice can easily be constructed away from the points where the earth is being taken out, which will convey the auriferous material to the machine. The improved machine consists of a ground pipe, which is composed of two or more sections, a sluice, a grizzly, regulating gate, elevating spout, flume, pipe and nozzle, &c. The two ground sections are preferably in two sections—or in one longitudinal section if desired—but in either case the sections are made in two halves. Each half is provided with a flange along each side, so that when the upper half is placed upon the lower half the two can be permanently fastened together by bolting the flanges together. By this means the lower half, upon which the greatest wear comes, can be renewed without renewing the upper half.

One section is bent upward with a gradual curve toward the ends opposite the attachment of the other section, and the lower end of the spout is secured to its upward bent end. These sections are made of cast iron, but the spout is made of wood. This spout can be of any desired length, according to the height it is required to raise the material from the excavation. The flume is attached to the upper end of the spout and is supported at an inclination downward, so that the water and material raised through the spout will be carried down through the flume. The flume can be made of any desired length, and is provided with riffles like an ordinary mining flume, so that the gold in the material raised will be caught in the flume. He thinks that the water coming through the hydraulic pipe with a velocity and pressure in proportion to the head or fall will drive through the ground sections and up through the wooden pipe and thence be carried off down the flume that this stream of water will draw into it by suction and carry along with it by force any material, such as earth, sand, gravel, or even large stones, that may be introduced into the rear end of the ground section, upon the well-known injector principle, but he is likely to be much mistaken. It is satisfactory, however, to know that Mr. Cranston comprehends the difficulties to be overcome, for it seems he is perfectly aware that it has been attempted to raise tailings from excavations in mines by placing a straight box or spout against the bank and introducing the hydraulic nozzle into its lower end, so as to lift the material directly in a straight line, and he thinks he has overcome the difficulty by providing a sweep of a curve at the lower end of the spout, so that the material to be lifted will be thoroughly mingled and in moving action with the water before the upward motion is given. Mr. Cranston's combination of a gold-saving flume with the spout will, it is hoped, enable him to accomplish at a single operation and with the same stream of water both the raising of the material and the separation of the gold and heavy metals, thus rendering the process economical, simple, and complete. MINER.

Cedar Creek, Jan. 20.

MINING IN QUEENSLAND.

SIR,—The quantity of tin forwarded from the Warwick Railway Terminus for the months of October and November were as follows:—

	Stream Tin.	Tin in Ingots.	Total.
	Tons c. qr. lbs.	Tons c. qrs. lbs.	Tons c. qrs. lbs.
October ...	400 15 2 0	... 5 7 2 12	... 406 3 0 12
November..	481 3 2 23	... —	... 481 3 2 23

That for November is not yet published, but I expect in a fortnight from date to give your readers the year's returns of the gross yield of the Stanthorpe and New England tin field.

The delay in sending the above figures is caused by the Commissioner for Railways refusing to supply them to me, as his department has done for the past 3½ years. His action in the matter has been most extraordinary, and appears personal; but the result has been that the above figures are published in the Government Gazette about the second week in every month, so that the information will be in the Journal about a week later in future.

The quantity of tin that came down in November was greater than that for any month since October, 1875, and is above the monthly average of 1874. The rise, no doubt, affected it a little, and ought to affect it much more this month, as the actual rise that has taken place in stream tin on the field is far in excess of the proportionate rise of ingots in London. Whether an increase in yield has actually taken place on the whole year I cannot form an idea, but hope to be able to lay the actual figures before your readers within a fortnight of this being published.

Tin has been raised in the north of this colony, on the main road between Cooktown (port) and the Palmer gold field. About a ton of stream tin has come down, and I have every hope that large and rich lodes of tin will shortly be discovered, as geologists call Northern Queensland new country. There is no fear of any extensive quantity of stream tin being discovered, but hope for the lode.

Copper has received a considerable impetus since my last. In the old Peak Downs Mine a new lode has been discovered of considerable breadth and richness, that has sent up the shares 100 per cent. The Great Northern Railway is advancing towards this rich country daily. It is expected to reach the "Comet" river by this time next year—141 miles, over one-half of the distance between the Peak Downs copper country and the port of Rockhampton. Another mine (the Dee) on this line of railway is sending down 10 tons of refined copper per week, and as soon as the new furnaces are finished this quantity will be doubled.

In gold the northern alluvial fields are almost all worked out, but the reefs are showing up splendidly. As each new crushing mill is erected, and the trial crushings from the adjacent reefs washed up, the results were looked for most anxiously, and have invariably proved equal to the miners' most sanguine expectations. The wet season is now set in all over the North, so that the returns for the next three months cannot be expected to at all reach the past three.

In other metals I have nothing particular to report. Coal, owing to the ignorance and apathy of our Legislative Assembly, has not yet had an opportunity to be exported—150,000 tons of shipping left Brisbane in ballast during 1875. We have the finest fields of coal within 20 miles, and up to 200 miles of the wharfs. We have the railway running right through this continuous coal field, and yet the Government will not make coal shoots, and join these shoots to the railway, a distance of from 1 to 10 miles, according to the site chosen as loading wharves. We have the finest timber in the world of unlimited quantity, also waiting shipment for the same reason.

Brisbane, Jan. 4. RESIDENT.

VIRNEBERG COPPER MINING COMPANY.

SIR,—The letter published in last week's *Mining Journal* relative to this mine shows how valuable is the information dispensed by Guides for the benefit of the public. The paragraph in Bradshaw to which your correspondent refers reads as under:—"Rheinbreitbach (left) is a large village, with castles and towers at the entrance of a valley, in which are the copper mines of Birnberg and Marienberg, now no longer worked, the largest having been inundated by the river." Presuming that by Birnberg is meant Virneberg (there being no mine of the former name in the vicinity), it is much to be regretted that the writer of this concise statement does not say at what period the inundation took place, for, as will be shown presently, the surface of the mine is so far above the Rhine that a Noachian deluge would be required to flood it from thence, while the workings having been carried 400 ft. or thereabouts below the surface of the river without incurring any inconvenience from water is sufficient proof that the catastrophe has not occurred through the lodes; in fact, the pumping engine drains the mine at the expense of only one-fifth of its power. Further, the mines (Virneberg and Marienberg) have been continuously worked for many years, while Bradshaw stoutly maintains (as I find the passage as far back as May, 1867) that they are "now no longer worked."

Descending from the realm of imagination to that of fact, I give below the translation of a letter just received from Repräsentant Mühlenbein (the manager of the mine), who has read the letter of your correspondent, and also the passage from Bradshaw. I also append a few extracts from reports of men who write what they have seen. Repräsentant Mühlenbein's letter is as follows:—

"St. Josephsberg, Feb. 27.—I have received your favour of the 24th inst. with enclosure, and am surprised how such nonsense can find its way into a Guide. The notice in Bradshaw's Continental Guide does not accord with truth in reference to Rheinbreitbach and the mine Virnberg, for Rheinbreitbach lies not on the left but on the right bank of the Rhine. You will see the absolute impossibility of an inundation of the Virneberg Mine when you consider that the mine is 2940 metres distant from the Rhine, and lies 120 metres higher than the level of the river. There can, therefore, be no question of an inundation of the mine by the Rhine, and there never has been any such thing, for the mine has been in operation since ancient times. Having acted as manager of this mine for 27 years past, I am thoroughly acquainted with matters here, and you may, therefore, rely on my information being accurate."

[The geographical section accompanying Mr. Mühlenbein's letter fully confirms his statement. The mine is about 2 miles from the river, and the rise of the surface is constant, so that the mine is about 450 ft. above high water level. The whole town of Rheinbreitbach would have to be some hundreds of feet under water before the mine could suffer; whilst "On the Safe Side" locates the mine on the opposite side of the river, and consequently 4 miles from where it really is.] The shaft being sunk about 250 yards; this gives over 100 yards of depth below the surface of the river, from which the engine keeps the water most easily.

Capt. John Holman, of South Caradon, says: "I find on the mine a good 60-in. cylinder Cornish pumping-engine, quite equal to your requirements."

Capt. Josiah Thomas, of Dolcoath, says: "They have also erected a 60-in. cylinder pumping-engine, so that there is now abundance of power for keeping the mine drained."

Capt. John Burgan says: "Especially I notice the powerful Cornish pumping-engine of 60-in. cylinder, and appliances ample for all requirements."

The matter, therefore, stands thus:—1. The mine never was inundated from the Rhine.—2. It cannot be so inundated neither from the surface nor by infiltration through the ground.—3. The pumping machinery is capable of meeting any difficulty which is likely to arise.

Sufficient has been said, I think, to satisfy your correspondent, or any other of your readers, on this point, but should any doubt still linger in their minds as to this or any other matter connected with the mine it will be best dispelled by a personal visit to the property, which is in all respects capable of speaking for itself. I shall be glad to furnish your correspondent with an order to inspect the mine if he will write me. T. R. CLARKE, Secretary.

London Wall, London, March 1.

VIRNEBERG COPPER MINING COMPANY.

SIR,—In the *Mining Journal* of Feb. 24 I notice that a correspondent ("On the Safe Side") asks whether the Virneberg Mine is the one referred to in Bradshaw's Continental Guide as having been abandoned on account of being inundated by water from the River Rhine. Having known the mine for some years, it is somewhat amusing to find such a statement in Bradshaw; it clearly shows the compilers are not well informed on the subject. As chairman, I desire to say the mine is not, and never has been, flooded from the Rhine; it has reached a depth of nearly 400 ft. below the level of the river, and though the engine is capable of working 10 to 12 strokes per minute, yet, in reality, the coming water takes only 1¾ to 2 strokes, leaving in reserve a difference for any contingency. The pumping-engine (Cornish) is an excellent one of 60-in. cylinder, with a 12-in. lift. The prospectus has been compiled with the utmost care, and your correspondent may be assured that so important a matter would not have been overlooked. I may add, the reports coming to hand show that the deepest level (110 lachter) is still improving in richness. S. C. HADLEY,

City Offices, Upper Thames-street, March 1.

VIRNEBERG COPPER MINING COMPANY.

SIR,—Having noticed the letter of "On the Safe Side," in last week's Journal relative to the above property, as I inspected it in May last, I am pleased in being able to answer his enquiries, as well as contradict the statement he makes. The mine is so situated that it is impossible for the Rhine to flood it, being by road 1½ mile from the river, and the shaft on the top of a hill. Relative to the power of the engine to drain the mine, I calculate it is capable of pumping four times the quantity of water I found there.

South Caradon Mine, Liskeard, March 1. JOHN HOLMAN.

VIRNEBERG COPPER MINING COMPANY.

SIR,—The enquiry of your correspondent "On the Safe Side" relative to this property, which appeared in the Journal of last week, seems a very reasonable one, after reading in Bradshaw's Continental Guide that "this mine had been inundated by the River Rhine." In answer to that communication, however, I have pleasure in saying that, having resided in Rheinbreitbach for four years and a half, and also had the management of the Menzenberg Mine, which immediately adjoins this property, I am able to state positively that this mine (Virneberg), as well as the neighbouring mines—Marienberg, Clemenslust, Rhine Mine (the latter being the nearest to the River Rhine)—have never been inundated by that river; neither is it possible for an occurrence of such a character to take place in any of them, and more particularly in Virneberg, as the new engine-shaft is more than a mile and a half (English) east of the Rhine, and is sunk to about 400 ft. below its bed. There is erected on this shaft, and now working, a substantial Cornish pumping-engine (60 in. cylinder) of ample power to drain the mine, with the coming water, to more than double its present depth. I have visited the underground departments, as well as at surface, a great number of times, and my last visit was in the latter part of December of last year, when the mine was thoroughly drained to its bottom level—110 lachters, or 70 under the deep adit. This I have great pleasure in stating, and would, moreover, say that the proprietary have here a property of great value, there being, in fact, opened up for some length, and available for stoping, a course of rich copper ore which can be taken away at a profit. The mine itself is well worthy the attention of capitalists; and if your correspondent will invest in it largely he will, I am quite sure, find himself "on the safe side."—*Feb.* 28. R. K. ROSKILLY.

THE LATE NEWFOUNDLAND MINING COMPANY, NOW THE LA MANCHE MINING COMPANY.

SIR,—I have received with astonishment a circular from Mr. Alfred E. Cooke, 011 Broad-street, London, and I will endeavour to correct some of the many misstatements that are therein contained. It appears that the La Manche Mining Company was formed in May last, the vendor, Colonel Fielden, having obtained possession of the property by foreclosing his mortgage of 5000*l.*, when a director of the Newfoundland Mining Company, although he was strongly opposed by me in the Supreme Court of St. John's, where I pleaded for a public sale, that the labourers, creditors, and shareholders should participate with him in any advantages which might accrue; however, I was defeated, and the labourers, creditors, and shareholders lost every shilling. Even the lead raised and dressed by the miners when in a state of semi-starvation, and without pay, could not be secured for them. At the end of two months moneys were again short but the required amount was advanced by me. In the following month a letter arrived to discharge all the men to whom he had previously promised 12 months' labour, and that they were to have but one month's notice. Winter was coming on, and the men determined to leave at once, and demanded their pay. There were no funds, and to prevent damage to the property (the men being in anger), I advanced their month's pay, and at once proceeded to St. John's, where I was detained several weeks before I could obtain funds to reimburse myself. To prevent actions at law being taken against Col. Fielden, in conjunction with the St John's financial agent, I re-engaged the men, and by this means saved Col. Fielden a few hundred pounds. Similar episodes occurred up to May of this year, funds rarely, if ever, at hand, and the agent at St. John's refusing to advance more.

The La Manche Mining Company was then formed, and took over the only machinery of any great value that was placed on the mine during the possession of the old company—an engine of the value of about 800*l.* The plant was and is in a dreadful state of dilapidation, and the whole of the works so badly laid out that on my arrival to take charge I was thunderstruck. After careful examination, and the prospects of the lode becoming encouraging, I wrote to my colleagues, informing them of the necessity of obtaining some 10,000*l.* or 12,000*l.* additional capital to put the mine in such order as was necessary to economise labour, produce a large output, and generally to put the plant in repair. I was assured by the secretary, Mr. Byers, to within a month of the collapse that the necessary moneys would be forthcoming, as he had personally canvassed his friends, who had originally taken shares at his solicitation. We then read, "That the unfortunate collapse is well known to have arisen solely from reckless and unprincipled management, and from no fault whatever of the mine, as the quality and extent of the ore has been over and over proved beyond a doubt." Now, the present mining captain when he arrived at La Manche, some eight months before the concern became insolvent, scarcely knew where to get a ton of lead, he having preceded me about two months, but the mine rapidly improved; and as we had barely 1000*l.* at the bank when I took charge, it appears to me difficult to understand this unwarrantable charge of reckless and unprincipled management. Colonel Fielden, in one of his letters to me, states that I had "done more for the concern than 99 men out of 100 would, or could have done," and I am surprised that Colonel Fielden should have allowed these flagrant misstatements to be made, for according to his own letters his colleagues, with one exception, were not men of capital.

As to myself, I was induced to come out, and was to be paid quarterly in advance, but not only was this not carried out, but

through Colonel Fielden's promises to pay me I was foolish enough to pay moneys of my own to keep the property intact. I was to have a good furnished house, and it was pointed out to me on the plan. Would you believe (having brought out my wife and a servant) there was no such place, and we scrambled into an unfurnished shanty, picking up a chair or a bed as best we could. The La Manche Mining Company has now been in existence about six months. The men not having been paid for three months, (although promised monthly payments) they are nearly starved, living on oatmeal, molasses, and tea, and to secure themselves have had to attach the lead. The mine is now closed, and it has not paid even the expense of the labour, notwithstanding the pile of stuff raised during the winter, that was taken over by the La Manche Mining Company, and estimated to contain 25 tons of lead ore, including the lead dressed since May, it will not amount to more than 42 tons, and for the last six weeks or two months no new ground has been driven, all stoping. As the men have now been left for the third time in eighteen months without pay, almost starving, I trust the Government of Newfoundland will step in and prevent such occurrences for the future. THE LATE MANAGING DIRECTOR,
Oct. 31. NEWFOUNDLAND MINING COMPANY.

THE RICHMOND MINE.

SIR,—If your correspondent, "Common Sense," is a shareholder in this company he should at once call a meeting together, and get the sense of the shareholders on the management and general conduct of the directors and secretary. Such a course of action would do more good that filling columns of your valuable space, and, moreover, would show that his intentions are honourable, which I fear some of us rather doubt. I do not promise to attend such a meeting, preferring to be "saved from my friends." One or two shareholders think the directors might safely pay the dividend now due, and give figures to support their views. Although I should extremely like to have the cash in my pocket, I still think it the safer policy to let it remain in the bank till we see how matters turn. There is plenty of money to pay the dividend and law expenses, and leave a handsome balance, but how about damages? We should not care to have to refund our dividends. That would, indeed, be sport for the "bears." Since the Flagstaff Mine has come out of the fire I am not so much afraid of American law courts as some people would have us. All the shareholders need at the present moment is a little patience, which would strengthen the hands of the directors in a very great degree. A SHAREHOLDER.

A NEW COAL FIELD.

SIR,—Another valuable coal seam has been discovered in this district, at the pits of the White Oak Colliery Company, which will doubtless be of great value for supplying the local and shipping demand for coal in the western districts. The seam is about 3 ft. 4 in thick, and the coal of a good bituminous quality, suitable for either household or steaming purposes. The sinking operations were performed by the Burleigh Rock Boring Company, of Manchester, who have, notwithstanding a superabundance of water, due to the extraordinary wet season, completed the shaft in about 15 months, with the aid of their rock-boring and air-compressing machinery. The depth at which the coal was struck was 165 yards, and the rock sunk through very hard pennant almost throughout. This goes far towards proving the advantages of machinery over hand labour for sinking purposes, and it is satisfactory to be able to state that the machinery has accomplished the work in the hands of ordinary miners, the repairs amounting to *nil* comparatively, notwithstanding the Burleigh Company's men have had to wind the water at the rate of 1700 to 1800 gallons per hour for the last six months. The work done is considered very satisfactory, and great credit is due to the Burleigh Company.—*Nailsea, near Bristol, Feb.* 24. G. E.

RITTINGER'S PERCUSSION FRAME.

SIR,—In the Journal of Feb. 17 I observe a remark made by Capt. Southey, to the effect that "the four minerals lead, blende, copper, and mundic could not be separated by water, on account of the slight difference in their specific gravity." Allow me, therefore, to make the remark that I have seen the simple contrivance termed Rittinger's percussion frame used with great advantage for this purpose in Germany, provided, of course, the stuff to be treated is of a uniform size, and not too coarse and tolerably free from impurities, which, according to Captain Southey, is the case at West Chiverton.—*Camborne, Feb.* 27. R. A. V.

UTILISING FURNACE SLAG.

SIR,—Although almost every attempt hitherto made to utilise furnace slag has proved unsuccessful, I really believe that the proposition of Mr. W. S. Williamson, of Congleton, is capable of practical application, and my reason for coming to that conclusion is that his manipulation costs comparatively nothing, so that the resulting product could be sold at a fraction more than the cost of carriage, for it should be remembered that at present the slag is an absolute obstruction, and that not only is it of no use, but the ironmaster frequently has to pay either for its removal or for land to deposit it on. Now, assuming the cost he incurs to be but 1d. per ton, it will at once be seen that if he can, at a cost not exceeding 1d. per ton, bring it into a form in which it is marketable at 1s., that amount will be added to his present profits, and in many works will represent a large annual revenue. In the patent he has recently secured he states that his invention relates to the slag from blast-furnaces and puddling-furnaces employed in the smelting and manufacture of iron, and has for its object to reduce such slag to a form or condition which will render it applicable to be employed for purposes of utility. To this end he runs the molten slag into water contained in tanks, cisterns, or reservoirs, into or through which streams of cold water are caused to flow in order to prevent the water from becoming heated to too great an extent. The effect of this treatment is to break up or comminute the slag into a condition resembling gravel. In the simplest arrangement he uses two cisterns or tanks, the slag being conveyed into one tank whilst the other tank is being emptied, or he uses one tank only, the converted slag being withdrawn continuously, or at intervals.

But this arrangement would probably only be applicable under exceptional circumstances, for unless the furnace were favourably placed the accumulation of the slag would soon become inconvenient. To avoid this Mr. Williamson also claims an elevator or chain of buckets, similar to those employed in dredging machines, to raise the converted slag out of the tank, or out of each tank—as, for example, he may use a tank having a portion of the bottom rounded to suit the path of the elevator-buckets and a chain of buckets extending from the bottom of the tank, or thereabouts, to the point of delivery of the slag; which, if preferred, may be discharged directly into wagons. The said tank may be made deepest at the rounded part, and formed with a decline from the point of entry of the molten slag to the said rounded part, the intention being that the slag whilst traversing the said incline shall become sufficiently comminuted.

With regard to the application of the iron gravel Mr. Williamson states that it may be used in lieu of ordinary gravel or cinders in the formation of roads or footpaths, and as ballast for use in the formation and maintenance of railroads, and may also be used in the preparation of concrete and beton, and for other purposes. Now, as to its use for roads and footpaths I scarcely think it applicable; at least, I know that Mr. Coulthard, an engineer, who was largely connected with ironworks, tried slag many years ago for the same purpose, and even got it used on roadways in London. The objection, I believe, was that it was too brittle and irregular, so that the roadway dished, and was always out of order—in fact, never got into order—and could not at all compete with sound granite metalling. But for concrete and beton I believe nothing could surpass it, wherever it can be delivered at 5s. per load or less, so as to compete with burrs. In districts far from building stone concrete would be much more largely employed if a regular supply of such material could be relied upon, and the cost of buildings would be lowered.—*Altringham, Feb.* 26. K. E. D.

CARDIGANSHIRE MINES A.D. 1877—No. V.

SIR,—Resuming my remarks from the Journal of last week, and the Court Grange Mine, we next have TYNEWYDD MINE, where there has been nothing done since 1874. The same remarks will apply to TYNANT and PENPOMPREN. Then comes CEFN GWYN, where they have laid open some ore ground, but nothing of any value has been discovered.

At PONTGOCH MINE nothing has been done, neither at LLANERCH, for the last three years. We have LLAWR CWMBACH next. In my remarks on this property in 1874 the following passage occurs:—"The ore has not been found regularly throughout the vein, but sometimes on the north and then again on the south walls of the lode; but I believe that with extensive machinery for drawing and crushing the whole of the lode would pay a profit on the working, and that the mine is richly deserving a vigorous trial, and that it will turn out to be rich and profitable in depth." Since this was written its truth has been substantiated by the working of the mine. The ground now being stoped is standing between two workings, one on the north wall and the other on the south wall of the lode, by far the richest portion being the middle or centre of the vein was left, and is now worth 30*l.* per cubic fm. as it is stoped away.

To the same cause we may feel assured is the falling off in depth of the greatest and richest mines worked in this country attributable, and to none other. To anyone practically acquainted with the veins of such sizes as Frongoch, East Darren, Great Darren, and in fact all the great lodes of Cardiganshire, and when we take into consideration that there is nothing in the strata or cross lodes to interfere with them both in length and in depth, to form any other conclusion would be nothing less than insanity. As long as the veins could be worked at their proper width above the adit level, where the stuff could be easily removed, and all the surface water could be made available for manipulating and dressing the ore, the yield of all these veins was simply enormous. When the task of drawing, pumping, and sinking became necessary the machinery was not able to cope with these large lodes, and the deeper the mines were sunk it was put down as a matter of fact that the lodes were dwindling away in depth. Another era will at some time dawn on Cardiganshire; machinery will have to be erected, both water and steam, of sufficient power for all purposes of working, and when this predicted time shall arrive it will be found that by proper management they will open out undoubtedly the richest lead and silver-lead district in the world. No amount of sinking has been carried on for more than 30 years, and that the mines have been enabled to return the vast quantities that have been extracted from them, considering the facts herein stated, is not only a mystery to me but to those who have had the management of them. As this mine was a proof positive of what I have stated, I took the opportunity of expressing these remarks at this place, and will in my next touch on Lletty Evan Hen, or the Vaughan Mine
Goginan, Feb. 27. ABSALOM FRANCIS.

LEAD MINING IN NORTH WALES.

SIR,—At Minera operations were commenced in the year 1850, and the first sales of lead ore took place in 1852, since which date, up to June, 1869, no less than 69,269 tons of lead ores were sold, and 23 000 tons of blende in addition, realising together 1,067,543*l.* The total costs and royalties paid amounted to 600,000*l.*, and the net dividends made were 466,254*l.*, being more than ten times the original capital of the company. There was, in addition, the sum of 9000*l.* in reserve and 715*l.* invested in land. The profits up to that date were 44 per cent. of the gross returns. For the year ending June, 1869, the sales amounted to 82,097*l.*; costs, 33,521*l.* 5*s.* 6*d.*; royalties, 6868*l.* 5*s.* 3*d.*; and the net profits, 35,707*l.* The share capital was 45,000*l.*, the dividends for the year 34,200*l.*, and the market value stood then at 315,000*l.* At that date the manager stated that the principal shafts had been sunk continuously, and had still a depth of 70 to 80 yards of lead-bearing measures below the deepest levels then reached. Everything led to the conclusion that the prosperity of the mine would continue for many years to come. Since this date upwards of seven years have passed, and the following results have been achieved:—The shares have been increased in number to 9000, and sell at about 180,000*l.*, or just 57½ per cent. of the price in 1869. This is a great falling off in market value, yet there are redeeming points in favour of investors at the date referred to—135 025*l.* dividends have since been declared, and the mine is still declaring dividends at the rate of 14,400*l.* annually, or equal to 8 per cent. on the present quotations. The dividends and present market price combined amount to 315,025*l.*, so that the great depreciation in the present worth of the property when compared with June, 1869, is slightly more than covered by the dividends paid. Hence the loss of interest is all the investor has incurred. Though the Minera is still a valuable property, it is evident that a limit exists to the lead bearing measures, or the manager would not have referred to the 70 to 80 yards in June, 1869. It would, therefore, be satisfactory to the general public to learn through your valuable columns the increased depth of the workings over the 7½ years elapsed since this important statement was made.

There is a great desire to embark in lead mines situate in the limestone rock, and great efforts have lately been made to get some of the formerly rich, yet long since abandoned, mines resuscitated. It is, therefore, highly important to know the data or principle upon which the depths of the lead-bearing strata is determined. If it is so accurately ascertained as to be realised 7½ years ago at Minera, can there possibly be any hindrance to a knowledge of the facts as regard every other lead mine situate in the lime lead-bearing measures of North Wales? The Bodidris, recently introduced upon the London market, is situate in the same district, and the executive are already working on two distinct shoots of lead ore. One at the 30 and 45 yard levels, proved to some length, and ranging in value from 1 to 2 tons of lead, and 10 to 15 cwts. of blende per fathom, and the other is cut in the shaft at the 60, and is now in the end east, and valued at 1 ton of lead and 10 cwts. of blende per fathom. This end is proceeding in the direction of the shoot of ore seen in the 45 and 30, and which evidently holds down.

These discoveries in a mine, so situate in the lime-rock, and possessing so favourable analogy of profitable surrounding mines, renders the future of great interest to mining investors, more especially so as the Bodidris is drained to a still considerable depth below the present workings through a swallow, which renders the working comparatively dry. Discoveries in this locality are very sensitive, and create at times immense increased wealth. At one time the Minera sold for 550,000*l.*; and, as in the case of all such inflated prices, the purchaser comes to grief. Still speculation will run rampant, and in most mining discoveries of note shares have sold above their actual worth until their inherent worth has become defined and determined. Of one thing, however, the investing public may rest assured—that should the 60 yard level open as anticipated at the Bodidris the present quotations for shares are far below their money value.

We referred to the position of Minera, and also of the Devon Great Consols, in the first number of "the Science of Investment," published in the autumn of 1869; and, however much it is to be regretted, there can be no question of the accuracy of our predictions. It is easy for practical miners to detect the time when a mine begins to exhaust its reserves faster than the pioneer operations develope ores equal to those brought to market. It is lamentable to reflect on the shortcomings of managers and executors who neglect to inform proprietors of these disentegrating elements, while they ever announce and fully report discoveries, no matter however evanescent and unimportant they may prove. The past yield and dividends from working a mine do not—or rather should not—interest a purchaser of shares. The true prospective chances of discovering other and profitable vaults and chambers of minerals can alone give continuous dividends, while the exhaustion of "reserves" may often keep up dividends for a time, even when all former points have become barren and destitute of promise.

It would prove interesting to receive half-yearly estimates of the reserves of many mines now returning large quantities of tin ores in Cornwall. Had we these half-yearly estimates for the past four or five years before us we could form an opinion of the value of Carn Brea, Dolcoath, Tincroft, and East Pool as accurately as the managers and executives themselves. We want skilled and practical miners to work our mines and look after the underground operations, and on the contrary we require clerks and accountants to keep the books, register discoveries of minerals, and to record returns brought to market. Then with a clear balance-sheet we could all comprehend the commercial worth of Cornish mines free from distrust, and embark capital therein with the same confidence as is experienced in every other branch of our home industries.
81, *Bishopsgate-street Within.* R. TREDINNICK,
Consulting Mining Engineer.

SCIENCE IN ITS APPLICATION TO MINING.

SIR,—I see by the Journal of Feb. 17 that your printer made a mistake in printing at the foot of my reply to Mr. Knapp's letter, of Jan. 30, "The author of microscopic ore dressing." I entirely ignore the authorship referred to, and give full credit to Mr. Knapp for the application of the microscope to dressing purposes, as the import of my reply plainly indicates. JUSTICIA.
Portugal, Feb. 22.

"JUSTITIA," AND CAPTAIN KNAPP.

SIR,—These gentlemen are in a bad temper, as the last two or three numbers of your Journal demonstrate. It is extremely unfair for a man incognito to be hitting a man who manfully signs his name to his productions, as Capt. Knapp does. It is, in my opinion, mean, dishonorable, and contemptible. If he wishes to fight Capt. Knapp he should do it on equal terms—*i.e.*, he should give his name. It is not often that the columns of the Journal have been so polluted as by this correspondence. I hope that the belligerents will try to carry on their discussion in a more Christian temper, and that "Justitia," who has such a high opinion of himself, will not be ashamed to emerge from his hiding place and show himself a man
Calstock, Feb. 27. J. THOMAS.

INVESTMENT FOR CAPITAL.

SIR,—Your St. Day correspondent, Mr. Charles Bawden, is very earnest in his attempts to promote mining, especially in his native county of Cornwall; and no one can reasonably object to such endeavours. But when he recommends a property he rarely says where a speculator may find it. He does not define its position that a man desiring to invest may readily go and see the property. The short advertisement of "a desirable investment," contained in last week's Journal, is of that nature. "It is in the richest known district in England," he says. Disputes may arise as to which is the richest mining district. He may hold that Gwennap is, but other persons may differ from him. Would it not be better to say where the "piece of mining ground" is situate? If the proposal is legitimate, which I do not dispute, why not name it? When I bring schemes before the public I always describe the properties so that no person can mistake their positions or characters; and if Mr. Bawden will take my advice he will do the same in future. I take it for granted that the quality of the property is fairly represented, but for the readers of the Journal to judge for themselves they require to know its name and whereabouts. R. S.
Feb. 27.

CORNISH MINING—THE GWENNAP DISTRICT.

SIR.—The great mines of this county—and, indeed, every other county—made what may be termed superficial bunches of mineral near the surface—or, in other words, to use a mining phrase, "made a chimney of ore," which lead to deeper and more profitable explorations. Instances throughout the county are so numerous that it will suffice to name only a few in the rich Gwennap district. In the western part of Treskvean the copper ore made within a few fathoms of the surface. The original expenditure of this great mine was only 1000*l.*, whereas 60,000*l.* was divided among the fortunate proprietors for the first year. The Great Consols original capital was not over 2000*l.*, which led to profits in 18 years of 320,000*l.* At Wheal Unity, in the same parish, the ore was first discovered about 10 fathoms deep, which led on to profits being shared by the proprietary of over 200,000*l.* The capital in this case was even less than the former, and there is yet undeveloped ground in this rich district requiring only a small amount of capital to prove the existance of a mine equal in value to any yet discovered.

To the west of those mines, and on some productive lodes, is a piece of mining ground, lying idle, not to be excelled, from which the ancient workers, without the aid of machinery, returned 60,000*l.* worth of mineral from surface to 40 fms. deep, but never penetrated through the transition stone from tin bearing to copper ground, in the bottom of which the desirable similiarity of the main superstructural characteristic conditions of the lode in question to the lodes of some of the most abundantly productive mines of the district can be seen. It is confidently relied on that very little further depth of development is required to ensure the realisation of a copper mine of very great value. This opinion is justified by analogy, to which practically scientific authorities will ever attach great importance, having proved to be the safest guide in forming their opinions of the inherent value of mineral properties. The mines of the Gwennap district commenced their great yield at about 50 or 60 fms. from surface, proving more and more productive in depth, and paying larger profits than any mines in the other districts of Cornwall; indeed, the Gwennap mines have realised altogether such astounding profits as have gained for them a wide-world celebrity, while the probabilities of the mine in question, sought to be worked by the co-operation of a few only, are such as will revive the remembrance of the brilliant era of Gwennap copper mining of former days, the capital required to embrace the opportunity being nominal when compared to the profits expected from its yield.—*Cornwall, March* 1. CHAS. BAWDEN.

WEST CHIVERTON, AND THE NEW MACHINERY.

SIR,—It is always satisfactory to persons interested in mining enterprises to hear of improvements in the mechanical appliances for the performance of their various operations being effected, resulting in greater expedition, combined with increased efficiency and economy in the general work of the mines, and especially in the manipulation of their produce for market. This it is well known is a department of mining which has long occupied the attention of the mining world, the old method of dressing being so glaringly deficient in points of paramount importance—among others those of inefficience, and the great expense necessarily attendant on the extensive employment of manual labour being perhaps chief; but until within the past few years very little progress had been made in bringing to perfection that great desideratum of mining adventurers—an automatic dressing-floor.

In view of the many mining enterprises that mainly through lack of appliances rendering these operations at once effective, expeditious, and economical, have collapsed, we hail with pleasure the advent of any improvements introducing a better state of things. Our most sincere thanks are certainly due to those whose assiduous and careful attention long bestowed on this subject has at length resulted in such complete success as to leave little more to be desired in this direction. I notice in the Journal of last week that our friends of West Chiverton rejoice in the recent introduction of improvements in their dressing operations. It is much to be regretted, however, that with the conclusive evidence so long before them of their backwardness in this particular they did not adopt the improved method much earlier. In short, it is to be feared that had it not been for Capt. Southey's visit to Wales we should not yet have heard of any material alterations or improvements in their dressing-floors; and this leads me to hope that in his zeal for the interests of his employers he has not encroached on the legally protected privileges of those whose machines he was allowed freely to inspect in operation at the Ystymtean Mines, for this system of dressing machinery is, I understand, the exclusive property of the Patent Mineral Dressing Machine Company, one of the principal features

of whose system is that of "classification by a series of different sized sieves," as described by Mr. J. Hocking, jun., at the meeting held at the mine a short time since. To this process of classification Mr. Hocking ascribes the entire success of the machinery at West Chiverton. It is to be hoped, however (though it is difficult to see how) that no infringement of patent rights has been perpetrated, as that instead of being matter for congratulation would be likely to result in unpleasantness to all concerned.

SPECTATOR.

TRENITHICK MINE.

SIR,—In naming the idle mines in St. Agnes, in a recent letter to the Journal, I put Trenithick Mine at the bottom of the list. "Last, but not least," I may fairly say in regard to this mine. It was recommended to me by several disinterested agents as the most eligible mine for resuscitation of all the unwrought mines in the county of Cornwall; and the miners who reside in the locality confirmed the agents' opinion. I have advised friends of mine in London to raise capital to develope it, believing that it will well repay the outlay, with ample interest. The lodes yield copper, of which four or five are said to intersect the property. The land belongs to Lord Falmouth and Mr. John Jose, who are about to grant at 1-18th dues. The old workings are on one lode only, extending to 30 fms. under the adit, which is 20 fms. in depth. All or nearly all the lodestuff above the adit has been removed, thus showing that it must have been valuable, and the excavations extend also below the adit, probably to the bottom of the mine; the lode is large. There are several shafts in the mine—two are fit for engine-shafts; the eastern one of the two is the proper one for the future engines; it is in a good condition for its reception. This was intended to intersect the lode perpendicularly at about 60 or 70 fms. from surface, if I correctly remember what was told me when on the ground, and the new company will doubtless continue the sinking of it.

A cross-cut was commenced and extended northward at the 30 to intersect a north lode, which was not reached, the miners having been driven off suldenly by the influx of water, leaving their tools, &c., behind them, and there they remain to this day, with a variety of other materials. I think the miners told me that that event occurred about 70 yearsago. In a previous working a very large profit was made by the late Mr. Daniell, of Truro and Trelissick, and his co-partners. The ore floors used by the old company are intact, and the waste ground is so much as to render payment for more land (if required) very light.

The mines at the west on the run of the lodes in this mine have yielded considerable profits—Great Wheal Charlotte, Tywarnhaile, &c. The copper ore taken up from an arch, left by the miners above the adit, shows the quality of the lode to be rich in its produce, specimens of which are now lying on the ground, if not carried away as specimens since I was there. The engine required to be erected is a 50-in. cylinder; this Lord Falmouth stipulates for, or for one not of less power than that. I hope to see shortly such an inviting mine in operation. The late Mr. David Stickland, just before his decease last year, expended several hundreds of pounds in preparing the shafts, ladders, &c., for developing the lodes in this mine. The money expended by him is so much saved to the future workers.

Truro, Feb. 26. R. SYMONS.

MINES NEAR ST. AUSTELL.

SIR,—While most of the mines in the St. Austell district are defunct--some of them from sheer exhaustion, and others from their insufficient metallic resources—there are a few still in operation. Charlestown United Mines, which yielded from tin sales about 400,000*l.*, are nearly idle, and have been so for several years, owing to the low price of tin, but all, or nearly all, the engines and other machinery are still *in situ*, and the company, represented by Mr. R. H. Williams, Asso. Inst. C.E., F.S.A., &c., is not dissolved, and the account-house is still used by them, chiefly as the offices for Eliza Consols, West Eliza Consols, and Crinnis Mines. Charlestown United is about 180 fms. deep, and contains several lodes, which will supply tinstuff of unlimited quantities, but which cannot be utilised with tin under 60*l.* per ton. It was worked by Messrs. Taylor and Co. profitably many years before the present company took it, who also made it pay, but what the profits were (if any) I cannot say. The extent of the aggregate setts is over a wide area, the chief mineral owner being the Duke of Cornwall, but there are several other lords, Major Carlyon being one of them. It is inconvenient to miners to have numerous grantors, because from each of them a lease must be had, at a charge of about 25 guineas. In some mines the leases constitute a serious item of expense. I have been informed that the Duke's agents are the best to deal with as regards conditions of leasing, &c. One of the pumping-engines on Charlestown United is used for pumping water out of West Eliza Consols by a flat-rod connection. The water there at present is inconsiderable, because the mine is still shallow. This is the only new mine started by Mr. Williams, all his other mines having been previously worked by other companies, but this mine is a virgin one, and I am gratified to learn that it gives indications of successful results. There are two principal lodes, which converge in going westward, and at the junction and elsewhere operations are in progress. It is remarkable that the narrowest of these two lodes is the masterly one, carrying the larger one with it. There are several other lodes in this mine.

Eliza Consols is a rich mine, yielding tinstuff of high produce, one-third of which is a clear profit to the company. The machinery and appliances are ample, and kept in the best order. As to the accounts, they are models, and might be usefully copied by other pursers. Payments are never in arrear, every item of cost being charged up as closely as possible. Mr. Bradhurst is the purser of this and of all Mr Williams's Cornish mines. The shareholders are very few in number, and a share has not changed ownership from the commencement of either of the mines. They are private properties, and such a thing as a transfer has never come to the purser's hands, which, I think, is what cannot be said concerning any other mine in Cornwall or Devon. In some mines the pursers have a great deal of work in the registration of shares, and in keeping their share ledger in order. These mines are not named in the *Mining Journal* because not dealt with, and this circumstance saves the agents from the trouble of foreign inspectors.

Crinnis Mine extends over a mile in length along the cliff from Crinnis to Par Harbour, and is of fair width, embracing several lodes and two cross-courses. The adit taken up in the cliff at high-water line is 20 fathoms deep in the mine, which is about 30 or 40 fms. below adit. In the 30 fm. level a cross-cut is driven to a lode under the sea. The engine, a 50-inch, pumps up the water, which is salt. The produce is chiefly copper ore, of good quality, associated with lead and silver. I saw there to-day some excellent specimens of ores, and of a metal I never saw before, called I think by the Germans "Fahlerz" a combination of copper and silver, worth about 25*l.* per ton. Mr. Williams always proceeds to work in a cautious spirit, never rushing into heavy expenses before testing the quality of the lode. In the first instance he erected here a very small engine. Having proved that the lode warranted development he erected the 50-inch engine. The buildings other than the engine-house are formed of wood. The labourers are paid every four weeks, their average earnings are about 4*l.* per month in all the mines, and they are so well served that they rarely migrate. The settings are not limited, as in most mines, to a month or two, and the contracts are executed with dispatch, because a reward is promised and paid if the work is accomplished in a stated time. "Time is money."

The manager, Mr R. H. Williams, is very conversant with mechanical contrivances, having an inventive genius. Wheal Eliza includes a grant of Tregrahan, the residence of Major Carlyon, but the surface is not to be broken under the lawn; a violation of that condition involves a penalty of 10,000*l.* The workings are underneath the lawn, considerably remote from the nearest shaft, which necessitated an artificial ventilation on Mr. Williams's plan, which is most successful, and very cheap. Mr. Williams is a great shipowner, has works in the North of England, and shares in numerous Cornish mines. I congratulate him on his prosperity. Great Crinnis, which yielded the late Messrs. Joshua Rowe and Co., it is said, 200,000*l.*, is included in Crinnis sett, and will be worked by Crinnis Company ere long. The late engine-shaft is near the bridge under the railway and over Major Carlyon's drive from Tregrahan to Crinnis Cliff. The burrows here, and in Pembroke and East Crinnis Mines, have been reduced, if not entirely removed, by the major, who has reclaimed from waste lately about 100 acres of land, and thereby improved his property and the scenery. From the time a traveller on the railway emerges from the St. Austell Station his attention is drawn to the heaps of debris thrown up by mining, of which he will not lose the sight till he enters the tunnel about two miles west of Lostwithiel, but all the mines which a few years ago exhibited the business of the bee hive are now as silent as death, except the three belonging to Messrs. Williams and Co.

The mine nearest St. Austell is called Polmear; the next is South Crinnis (both these were managed by the late Capt. Barratt), Charlestown United, Great Crinnis, Pembroke, New Pembroke, East Crinnis, Par Consols, West Fowey Consols, South Fowey Consols, Fowey Consols, and Polharmon. All these are seen from the railway. If anyone had said 20 years ago that such a state of affairs would exist in the year 1877 he would not be credited. Looking at the desolation of the district, it is remarkable that so few comparatively of the dwelling houses are vacated. Fowey Consols, Par Consols, and East Crinnis are regarded as exhausted mines, but the others must not, I think, be placed in that category. It is, indeed, scarcely safe to say what mine is exhausted, because some mines so regarded in past times have been subsequently worked with advantage.

The gullibility of capitalists has been shown in their belief of the reports of rich deposits left in sight at the bottom of abandoned mines. It is absurd to suppose that a mining company would abandon a mine with riches exposed to view. I have, however, known reputedly intelligent men imposed upon by such lying reports.—*City of Truro, Feb.* 23. R. SYMONS.

BARNARDIAN RHAPSODIES.

SIR,—Mr. Barnard has been condemned a great many times as one who wilfully misrepresented things in connection with the properties to which he so excitedly drew attention in the past. I would direct your readers to one of the said mines, which, passing from the shareholders through their own impatience, has at length proved itself to be what Mr. Barnard foretold—a trump; at the Queen a lode has been cut composed of carbonate of lime containing silver to the value of 1000 ozs. per ton. This fact speaks for itself. After this can we say that Mr. B. was too sanguine?

A CALLINGTONIAN.

LEAD MINING AS AN INVESTMENT.

SIR,—A few months ago you were so courteous as to insert a letter from me on the subject of the Brodignag Mine. I then ventured to predict that it would become one of the first mining properties of the day, and now I am happy to say that this prediction has been fulfilled. The present condition and prospects of the property surpass my most sanguine anticipations, and not only realise all that the possessors of the property could expect, but really all that they could wish. It may be admitted that those interested usually exaggerate, especially when prospects are fair, but in mining matters few have of late years been disposed to look forward in a sanguine way; on the contrary, a very prevalent tone of despondency has pervaded all the sayings and doings of mining people, and this has prevailed to an unreasonable and mischievous extent. Happily the position and prospects of the Brodignag Mine, and of several others which I could name, encourages the hopeful side of the case, and as for the present I have only to do with the Brodignag property I will confine my attention to that. It is, however, important to promise that mining for lead is unquestionally in the ascendant. It is scarcely necessary to say why, but no one acquainted with mines and mining matters can fail to see that while tin mines have rendered splendid results in the past, and possibly fresh discoveries in the Cornish peninsula may enable the discoverers to reap as glorious harvests, that at present the deep mines of Cornwall requiring heavy capital and expensive labour cannot compete with the shallow mines of the great Eastern Archipelago and Australia, the labour in the former being about the cheapest in the world.

Much the same may be said of copper mines. Chili, the Cape of Good Hope, and Australia can produce at a greatly cheaper rate superior copper. This is as things are; they may change, *Tempora mutantur et mutamur cum illos*: but until circumstances alter, the facts as they are must be recognised. Lead mining is the safest, surest, and realises the speediest profits of any metalliferous properties in England. They require less capital to work them, the treasure is nearer the surface, the market is a prompt one, and the demand increases beyond all proportion in comparison with other metals. This is especially the case in connection with buildings, for which the metal is becoming more and more in requisition, and never in the history of this or any other country were building projects contemplated on so vast a scale as is now the case. This will be signally seen in the course of the present spring if it be only tolerably fine, for all building operations were retarded in an extraordinary manner by the incessant rains of an otherwise mild winter. It should also be kept in view that the quality of British lead is not surpassed, and that there is a ready market for it all over the world. Moreover, the quantity raised is not really increasing, although England, Wales, Mona, and Ireland contain vast resources, and we are actually obliged, notwithstanding our own vast unworked deposits, to import more than we raise. Miners should always be on the alert as to the turn the demand for metal takes. *Nunquam Dormo* should be their motto, which will allow the peculiarly English translation of "Wide awake." "Heavy as lead" is an old and trite phrase, but lead rarely makes the heart of those heavy who mine for it, but often gives a light heart when other fields of mining have depressed them.

If any of your readers, amongst whom there is so many experienced miners and and great capitalists, wish to see a thoroughly good lead mine, one in which it is desirable to purchase an interest, one prolific in present and prospective wealth, let them pay a visit to Brodignag. It is not too far off, it is not in Colerado or Nebraska, or the the land of the Mormons, it is nestled in our neighbouring Welsh hills, inhabited by the most tranquil and obedient peasantry in the world. It is situated in the county of Denbigh, in the parish of Llanarmon in-Yale, and held under grants from well-known landowners—Sir Watkin William Wynn, Mrs. Foulkes, and L. Adams. There are good roads and railways at hand, and cost of carriage is per consequence light. There will not be the usual costs in a new mine of any kind, such as "working for discoveries," they are already made, and the proceeds can be brought to surface and to market forthwith, nor for expensive machinery, all such requisites are at hand. The thing is to be perceived in all its entirety and value by any competent person who choses to look at it.

It is very seldom indeed such such results are obtained by the operations of a newly-formed company as that of the Bodidris has secured, although from the proximity of the rich old Minera Mine, and the far-famed Westminster Mines, great things were reasonably expected; the former having for 30 years made immense returns, and the shares have risen from 5*l.* to 20*l.*, and when general business was better fetched 22*l.* 10*s.*; the monthly returns having also increased from 16 tons to nearly twice that, and pays over 25 per cent upon the original price of shares. The Westminster has raised 400 tons per month. Situated beside such thriving neighbours I could not deem myself a mere vaticinator in asserting in your columns, as you kindly allow me to do, that the Bodidris would be a remarkable investment, and probably destined at no remote day to rival the Minera. Accordingly recent discoveries have confirmed the most sanguine hopes entertained.

In working the main or middle lode at a shallow depth of not more than 30 yards a rich course of ore has been discovered, producing at intervals as much as 3 tons of lead per fathom. A deeper level was driven to intersect the lode at 45 yards, where the lode was found equally rich. These levels have been merely driven through the lodes, laying upon a large quantity of stoping ground, which is untouched, forming a reserve. It will be seen that the second discovery confirms the first, and proves to demonstration the very great value of the property. A third and deeper level is now being driven to meet the course of ore at 60 yards, and there is every reason to predict a splendid success in this instance also. Opinion in all the mining districts of Denbigh and its contiguity is undivided as to the splendid triumph of this undertaking; and the officials, and, indeed, the men working at the Minera, that it is scarcely second even to that brilliant success. Indeed, it could not be otherwise, for all the elements of prosperity which indicated the colossal fortunes which have been made by mines in the vicinity of Bodidris are shown in it. JOSEPH J. REYNOLDS.

Finsbury place, March 2.

[For remainder of Original Correspondence see this day's Supplement.]

PAY GOLD IN THE NEW SOUTH WALES COAL MEASURES.—Mr. C. S. Wilkinson F.G.S. writes from the Geological Survey Office, Gulong, under date Nov. 25, to the Mining Department as follows:—"I have the hanour to acquaint you, for the information of the Hon. the Minister for Mines, that during my examination of the Tallawang Gold Field Reserve, I observed the important fact that the gold found in the tertiary alluvial deposits at the old Old Tallawang and Clough's Gully diggings has chiefly been derived from conglomerates in the coal measures. These conglomerates are associated with beds of sandstone and shales containing the fossil plant characteristic of our coal measures, the Glossopteris. At Clough's Gully the conglomerate *in situ* is being worked, and yields from 1 dwt. to 2 dwts. of gold per ton, and nuggets weighing up to 5 ozs. have been obtained from it. Several hundreds of tons of the conglomerate (locally termed cement) have been crushed; but as the yield is said to have been 'patchy' or variable, work has been stopped, and the ground is now held under lease. There are, however, a few miners still at work in the adjacent claims, and I took the opportunity of purchasing from one of them a sample, weighing 1 oz., of the gold, which he was crushing by hand out of the hard cement. The gold is coarse in size, remarbably scaly, and water-worn. I hope to secure for the Museum of Mines some samples of the conglomerate containing gold. Mr. R. M'Kay, of Clough's Gulley, gave me one small piece showing coarse gold. This is the first time that gold has been noticed to occur in payable quantity in the coal measures in the colony; and it is not unworthy of remark that we here possess one of the most ancient auriferous 'alluvial' deposits in the world. It affords me much pleasure in thus adding the above testimony to the researches of the Rev. W. B. Clarke, M.A., F.R.S., who many years ago ascertained the occurrence of gold in minute quantity in the Hawkesbury Rocks, at the North Shore, Sydney, at Govett's Leap, and in the conglomerates of the coal measures in the Southern district, in which latter formation the late Sir Thomas Mitchel also found a speck of gold in a pebble of quartz, and he communicated his interesting discovery in a letter to the Rev. W. B. Clarke, in June, 1855 (see 'Southern Gold Fields' and 'Discovery of Gold in Australia'). Gold is also stated to occur in the coal measures at Peak Downs, in Queensland; near Hobart Town, in Tasmania; and in New Zealand. But apart from the scientific interest attaching to the subject of the geological age of auriferous alluvia, the fact that gold in payable quantity has been proved to exist in the coal measures is one of considerable importance; for it may lead not only to the working of some of the conglomerate beds at the Old Tallawang diggings, but also to the discovery of other similar auriferous patches which no doubt occur in the Tallawang gold fields, and in other parts of the colony where the same geological features are presented. You will be gratified to know that, amongst a collection of tertiary vegetable fossils which I lately submitted to Baron Ferd. von Mueller, C.M.G., M.D., F.R.S., that distinguished botanist has discovered no less than seven genera and nine species of plants new to science. Most of these fossil fruits were found beneath basalt, at a depth of 160 ft. from the surface in No. 23 claim, 'Black Lead,' Gulong. The Baron has generously afforded me his diagnosis and description of these fossils, which will form a most valuable contribution to the scientific elucidation of the geology of the tertiary period in Australia. While referring to fossils from the gold drifts, I may mention that when lately inspecting the Gulgong gold fields, in company with the Hon. the Minister for Mines, and Mr. Warden T. A. Brown, I obtained a fine specimen of the fresh water *Unio* from one of the deep leads. This relic of the past is specially interesting, as being the first fossil shell of the kind yet discovered in the pliocene tertiary gold drifts."—*Sydney Herald*, Dec. 2, 1876.

Meetings of Public Companies.

SOUTH WALES COLLIERY COMPANY.

The fourteenth ordinary general meeting of shareholders was held at the Cannon-street Hotel, on Wednesday,

Capt. LAWRENCE HEYWORTH (the chairman) presiding.

Mr. J. MOUAT F. HUNT (the secretary) read the notice calling the meeting.

The CHAIRMAN said they were met to receive the accounts of the business of the company for the past half-year, and it was the province of the shareholders now to criticise the report, and pass their commendation or not upon the acts of the directors. The post of director had not been a very pleasing one to occupy; during the past half-year there had been considerable divergence of opinion upon the board, and unfortunately the directors had placed him (the Chairman) in a position which he had regretted exceedingly, for it had been a very painful one to himself. As the representative of the shareholders, and having been connected with the company from the commencement, he felt that he could not resign his seat unless by their authority. (Hear, hear.) His only object in retaining his seat had been to protect as far as he could the interests of the shareholders, and see the company managed in an honest, straightforward, and profitable manner. Proceeding to a consideration of the balance, he said they would see there had been an increase of the capital by a total sum of 2807*l.* 1*s.* 3*d.* In times like these it was imperative that the capital account should be closed, and no further sum be expended upon capital account. There were some points which remained to be completed; for instance, the cottages were still in an uncompleted state, and it was to the interests of the company that money should be spent on those cottages to complete them. With this exception, there did not remain much to be done on capital account. When they came to the cottages they would find it stated that 210 cottages and two public houses had been built by the company; that was not correct—that number did not exist as built by the company; 198 had been built by the company, and one public-house. Referring to the cottages recently built from his own designs, he gave figures showing that they had cost considerably less than some which had recently been tendered for on the plans of Mr. Lawrence, the managing director, and which latter cottages Mr. Lawrence had always stated would cost much less money. There was an increase on capital account, contrasted with the year 1875, of the sum of 7158*l.*; this was for the year. The increase on truck account was 84*l.* for the half year. The trucks, as far as he could judge, had not been repaired, as they ought to have been, during the past year, and not one had been rebuilt. It had been customary to rebuild two or three every half year, working up the old ones, and building perfectly new ones of 8 tons instead of 5 tons, the cost of which had been charged as repairs, and consequently the truck account had been in course of reduction; but this half-year no new trucks had been built, and no new wheels and axles had been supplied. He considered the truck account in a very unsatisfactory state. There had been an increase in the loss standing against the company of 916*l.*, which they would have to recoup before they declared any dividend, and of that amount 586*l.* had accrued during the past six months. This was a most serious thing. The remaining uncalled capital was not large; the uncalled balance on new shares was now only 5*l.* per share, and that was gradually oozing away, and very soon they might find themselves in a position which might be very serious indeed, wherein there would be no option but to go into liquidation. It was indispensable that that loss should be stopped, and it could be stopped if the proceedings of the board were dictated by a correct policy. Turning to the report, he had already informed the shareholders that he had signed that report by order of the board, *pro forma*. He made objection to several points, but they were carried against him, and as Chairman he placed his signature to the report *pro formâ*. Alluding to the first paragraph, he characterised as absurd the statement that "the protracted enquiry at the inquest" on the persons killed by the explosion had led to an increased loss of about 1200*l.*, and a further sum of 1000*l.*, which would have to be borne by the current half-year. As a matter of fact the total cost that might accrue in twelve days was charging the keep of the horses and paying the staff of mechanics, carpenters, &c., at an outside estimate not more than the amount of 50*l.* The output of coal had been very large; in fact, in his experience of the colliery, with the exception of the first six months of 1875, they had never had such a regular trade, nor a time when the colliery could be worked cheaper. The question of locked lamps was one which there had been a good deal of dispute about, and he was strong y of opinion that the board had followed a mistaken policy in insisting upon locked lamps. In corroboration of this statement he quoted the opinion of a well-known mining engineer, who was thoroughly acquainted with the district. He defended the course he had pursued in giving evidence at the inquest which was held after the explosion, his object being to prevent, if possible, the introduction of locked lamps. He was convinced, in his own mind, that the cause of the explosion was simply negligence and want of ventilation, and if the ventilation had been in as strong a state as it was before the furnace was put out there would have been no explosion. Referring to the statement in the report that the loss upon the working for the half year was "more apparent than real," he said that statement was specious and fallacious. He denied that some of the expenditure was of the exceptional character which the rest of the board had described it to be, and said that three or four years ago they were driving through ground just as hard as any they had driven through to-day. The question for the shareholders now to consider was what was best to be done in the future. The past was gone, and could not be recalled, but they must take advantage of the experience of the past year, and take care not to fall into the same error in future. He strongly advocated a policy of retrenchment, not only in the cost, but also in the production of coal, because it was ridiculous to go on sacrificing the property at the present low prices. It was far better to lose 1*s.* 6*d.* per ton upon 2000 tons than 1*s.* per ton on 4000 tons, because in the former case, in addition to mining loss, there would be the coal left below ground; and, therefore, whilst there was the prospect of the continuance of bad trade they should reduce the colliery to the lowest possible get. They should discharge all the extra labour which they did not require, and put themselves in the position of a ship in a gale of wind, which reduced all sail, and only carried just sufficient to keep her head to wind. The right policy was to reduce the get to 2000 tons per week, if not less; discharge the extra men, and bring down the cost as much as possible. He had entirely differed from his colleagues in 1875 in pressing on the get of the Elled coal, as that had been a very difficult and expensive coal to get; heretofore they had been endeavouring to work this coal under great disadvantage, and he thought they might have postponed the development of that coal until they could get it from the Rose Heyworth pit, when it would be the cheapest coal of all, whereas it had been the dearest. In 1875 the board had thrown away 3000*l.* in prosecuring the get of the Elled coal, and in the present year 2 60*l.*, so that 5000*l.* had been thrown away in working that coal at a great disadvantage, which might have been saved by proper management. Having made these remarks, he said he was unable to move the report and balance-sheet, as they were both of them incorrect. He would, therefore, leave it to the managing director, Mr. John Lawrence, to propose the adoption of the report and balance sheet.

Mr. HOWARD JOHN KENNARD moved the adoption of the report and accounts, which, with the exception of the Chairman, had the unanimous support of the board. Referring to some of the events of the past year, he said that the board, being unable to work harmoniously with the Chairman, had requested that gentleman to resign, which up to the present he had not done. (Hear, hear.) He mentioned that the board entirely disapproved of Colonel Heyworth having given evidence at the inquest. Therefore, when the re election of directors came on the board had resolved to unanimously support another gentleman in opposition to the present Chairman.—Mr. W. H. CHALLIS seconded the adoption of the report.

Mr. R. POTTER said he judged of success by results, and it was clear that the results obtained when Colonel Heyworth was managing director were much more satisfactory than during the past year since Mr. John Lawrence had been managing director. He considered that Colonel Heyworth during the years he had been managing director had worked the colliery in a workmanlike manner, and he ascribed much of the present movement against Colonel Heyworth to the unworthy agitation of a local clique, to whom the constant vigilance of Colonel Heyworth was very unacceptable. He characterised in strong terms the management of Mr. John Lawrence, and pointed out that the cost of getting the coal under Colonel Heyworth was considerably lower than since Mr. Lawrence had been managing director.

Mr. JOHN LAWRENCE, in a speech of considerable length, gave figures and statistics, with the view of justifying the statements in the report and defending the action of the board since he had been managing director. He added that nothing would induce him to continue to fill a post which was surrounded by so many unpleasant circumstances.

In the course of a long discussion several gentlemen expressed their sympathy for Colonel Heyworth for the unpleasant position in which he had been placed, and their confidence in his management. Mr. Bowyer, however, thought that some other gentleman should be elected in the place of Colonel Heyworth.

The report was then adopted, 12 voting in favour of it and nine against it.

Mr. W. H. Charles was then re-elected, nine voting in favour and seven against.

Mr. THOMAS COLBORNE moved that Mr. Wm. Graham be elected a director in the place of the Chairman, stating that Mr. Graham was well qualified both by position and experience to fill that position.—A SHAREHOLDER seconded the resolution.

Mr. HEATH proposed the re-election of Colonel Heyworth, and spoke in high terms of the great service which that gentleman had rendered the company. He considered the shareholders would be acting very unwisely if they allowed Colonel Heywood to be displaced in consequence of the agitation which had been going on.

Mr. GEORGE SMITH seconded the resolution.

A show of hands was taken, when the voting was equal.

Two or three gentlemen appealed to the Chairman not to allow any false deli-

cacy to stand in the way of voting for himself. The Chairman then gave the casting vote in his own favour, and was, therefore, re-elected.

A poll was about to be demanded when

The CHAIRMAN said he would save the meeting any further trouble, and would at once put in execution the intention which he had had for some time past, and resign a post the conduct of his colleagues had rendered harrassing in the extreme, and tended to neutralise any efforts he might make on the shareholders' behalf.

Mr. Graham was then declared duly elected a director.

A SHAREHOLDER frankly expressed his opinion that the party who had been acting in opposition to the Chairman had behaved very shabbily.

The auditors were re-elected, and the meeting broke up.

GREEN HURTH LEAD MINING COMPANY.

At the annual meeting of shareholders, held in Newcastle, on Feb. 27 (Mr. J. C. SWAN in the chair), the accounts showed a credit balance of 2010*l.* In answer to the enquiry as to the cause of the suspension of dividends it was explained that since the payment of the last dividend the outlay for lead ore dressing machinery, with the necessary buildings, roads, and excavations connected with the same, amounted to between 2000*l.* and 3000*l.*, which had all been paid out of revenue, and was equal to a dividend of 8s. per share. This machinery is now in good working order; and, as the balance above named is free from any material outlay for further plant, &c., and an improvement is noticed in several parts of the mine, it may be fairly expected that during the present year the directors will feel themselves in a position to resume dividends. The customary re-election of directors who retired in rotation was made, and Mr. J. H. Robinson, who has for many years performed the duties of secretary, was also elected a director. The business of the meeting, which was rendered of a very agreeable character, by the unexpected announcement of an important discovery at the northern part of the mine, was brought to a close by a very hearty vote of thanks to the Chairman for his valuable services to the company for several years past.

GREAT WEST VAN LEAD MINING COMPANY.

An extraordinary general meeting of shareholders was held at the Guildhall Tavern, on Monday, for the purpose of taking into consideration the most advisable means of providing the required capital for the further development of the mine, and pass resolutions thereon. Mr. MATTHEW GREENE was voted into the chair.

The CHAIRMAN said: Gentlemen, you are all aware of the purpose of our being present here to-day. At the general meeting of the company, which was held on the mine in July last, a great many shareholders attended it and went underground. We had then a very fine discovery of lead in the 46, east of Eliza's shaft, and we were so impressed with its importance that, although the company's capital was nearly absorbed, we thought we might do without calling for more. This discovery has continued now for over 20 fms. Lead ore having been found nearly the whole distance, and also in the driving west from the old mine; but the time occupied in sinking winzes and making communications for ventilation has been much longer than anticipated, and consequently we have not yet been able to avail ourselves of the lead ore already discovered. The mine has within a short period been inspected by several competent experts, and their opinions and reports all confirm what we already knew, that we have a valuable mine here, but must do the work indicated, and then we can take away our lead recently discovered at a very good profit. I will only trouble you with reading Capt. Bray's report.

Mr. G. SHARP: What Capt. Bray is that?——The CHAIRMAN: Capt. Bray of Powell Consolidated; he is a well-known man, and perfectly acquainted with the district.——The report of Capt. Bray was then read.

The CHAIRMAN: I have also letters from one of our directors, Mr. Adam Murray, who has spent the greater part of the last three weeks at the mine and district. I will read you the one sent me this morning, accompanying the plan you have on the table before you:—

I beg to forward you my proxy for the general meeting on Monday next, and at the same time I have thought it advisable to trouble you with a sketch of the property, containing a couple of sections and a plan of the valuable ground surrounding Eliza's shaft. The two ends of the 46 will not have more than 28 to 30 fms. to communicate on a course of ore worth 25 cwts. per fathom, and the 46, west from Eliza's, will only have the same distance to reach a junction with a north lode, and most probably would be driven in an improving course of lead ore up to that important point. These drivages are second only to the sinking of Eliza's shaft in the future prosperity of this mine, for the sinking of that shaft another 14 or 15 fms. would reach the junction of these lodes in depth. During my late visit both ends at the 46 (Eliza's) had very much improved; the western one in particular assumed a much more productive and compact character after passing a side branch which has run on the opposite wall, and may be very productive in that direction, also towards the junction, for we explored to the south wall and found the lode to be 18 ft. wide, and containing lead on that side also. There is an enigma to solve regarding the 34 and 46 ends (Eliza's), for the latter is on a course of lead and calcareous spar 4 ft. wide, containing large and beautiful fissures, highly crystalline, and many lateral branches of the same characteer, but containing much less lead, diverging to the opposite wall, and the end and level are quite dry, whilst the 34 fathom level above is extremely wet. This may be accounted for, however, as the 34 fathom level is on another course of ore on the south wall, which has been the most productive part of the lode in the old working in the eastern part of the mine, and may have a parting division between it and the course of lead on the north wall, or it may be caused by some twist in the lode between these levels, which the plan may tend in some way to explain. There are many other points for consideration and eventual operation in this mine, and a considerable quantity of valuable stoping ground in the backs of the 22 and 34 still to come away, but these matters may be prudently deferred to the great importance of sinking Eliza's shaft, and communicating the 46, for which Mr. Thomas Gundry has entered into a calculation, showing that these operations may be performed in six months at a cost under 200*l.* per month, without reckoning the lead that would be returned in the meantime. * * * * The monthly value of the lead ore and about six months' supply of oak timber is not included in this estimate.—ADAM MURRAY.

Mr. THOMAS GUNDRY has also inspected the mine, and has written me similarly. He has furnished an estimate of the probable cost for the next six months, which he calculates will be about 200*l.* per month. Mr. Murray's estimate is also somewhat about that amount.

The CHAIRMAN: That, gentlemen, is the present state of the mine, and we have to devise means to carry on these works. If you have any questions to ask I shall be pleased to answer them, and afterwards, if the meeting has any proposal to bring forward in regard to raising the required amount we can discuss it. I would mention that the directors have taken a very great interest in this mine, as you will see from the attention and trouble they have taken in personally inspecting it, and they have a proposal to make, which, in the event of the meeting not bringing forward a better one, they think it will be for the benefit of all to adopt and carry out.——Mr. G. SHARP: What is the depth of Eliza's shaft at present?——The CHAIRMAN: 46 fms.——Mr. G. SHARP: At what depth is the junction of these two lodes to be intersected?——The CHAIRMAN: Capt. Bray thinks, that in about 10 fms. we may meet it, but Mr. Murray says 14 to 15.——Mr. SHARP: How soon do you expect to complete this work?——The CHAIRMAN: Well, it should be done in six months; but the cost I would put a little higher than either Mr. Gundry or Mr. Murray. Mr. John Kendall is present, I see; he can, perhaps, give us some information, as he knows the mine.——Mr. J. KENDALL: I am not quite competent to speak on that point. I quite believe any statement Mr. Murray has made. I have not been to the mine for two years.

Mr. J. LITTLE: What has been the cost for the last six months?——The CHAIRMAN: It has averaged 230*l.*——Mr. LITTLE: I think it is much better to take that as the probable cost for the next six months, you will not be able to do more work for less money.——The CHAIRMAN: I agree with Mr. Little; it is much better not to estimate cost too low. My experience leads me to the opinion that however carefully you may estimate your work, things that were unforeseen have to be done, and the cost is more likely to be 50*l.* over than under when you come to pay the cost-sheet.

Mr. WALTON: What is the amount you think you will require?——The CHAIRMAN: Well, we have carefully gone into the matter, and think that 5000*l.* will be quite enough, because directly the 46 fm. levels are communicated, we shall return ore gain.——Mr. KENDALL: 5000*l.* seems a very small amount; is it not better to create more than that—5000*l.* soon goes in a mine?——The CHAIRMAN: That is very true if we have no ore, but we have a very fine run of lead in the 46, east of Eliza's, and in driving that level we shall doubtless make fresh discoveries before these points are communicated. With the ore already in sight, without calculating on any more discoveries, this 5000*l.* would last three years.——Mr. SHARP: You ought to make good discoveries when Eliza's shaft is sunk to the junction. Perhaps the Chairman would let the meeting know the proposal the board has to make in reference to raising this amount, and the meeting could then discuss it.

The CHAIRMAN: The directors very anxiously considered this matter, and they were met with the difficulty of raising the money in such a way as not to injure the existing shareholders, but still to offer such an inducement as would get the money subscribed, although the present shares are at such a nominally low price. The plan they propose is this:—That 2500 new shares be created at 2*l.* each, and that these new shares be offered at par *pro rata* to the present shareholders, with this benefit or preference, that they shall have 20 per cent. of the profits of the company divided among them, and that they also participate equally with the old shares in the distribution of the remaining 80 per cent. of the profits.—The meeting then thoroughly discussed this proposition.

Mr KENDALL: Do these new shares, then, have 20 per cent. more than the others?——The CHAIRMAN: It is not 20 per cent. more than the others. It is one-fifth of the whole profits more than the others. If you only gave 20 per cent. more than the existing shareholders that would not form a sufficient inducement to get the money subscribed, because if the mine opened out, as we think it will, then it would be better to purchase old shares than take new at par, whereas if you take up the new shares with 20 per cent. of the profits extra, in the event of the mine turning out well these shares would become of great value.——Mr. PARRY: I see you do not injure the old shareholder.—The CHAIRMAN: No, not at all; but you must give some benefit to those who provide the funds, seeing that the present shares are so low, and the old shareholders have only to take up their quota one in ten to stand the same as before.——Mr. WALTON: I cannot see how we can adopt a better plan; if the mine is as good as it is represented the shares should be all taken up.—Mr. KENDALL: We are certainly much better off than we have ever been, as we have made these discoveries at Eliza's shaft.

The CHAIRMAN: With your permission, gentlemen, I will now submit the resolutions:—1. That the capital of the company be increased by the creation of 2500 additional shares of 2*l.* each, to be known and distinguished as "preferential shares," and that such shares have 20 per cent. of the profits of the company divided among them, besides participating equally with the ordinary shares in the remaining 80 per cent. of the profit.—2. That the said preferential shares be issued *pro rata* to the present shareholders, and that they be paid for as follows—10s. on application and 10s. on allotment, 10s. at three months and 10s. at six months from date of allotment, and that all shareholders not taking up their proportion of these shares by March 20, 1877, do lose all right and title to them, and that such shares be left in the hands of the directors for disposal at not less than 2*l.* per share.

These having been duly seconded, were cordially approved of by all the shareholders, and unanimously carried.

The CHAIRMAN stated that Mr. Gundry had advanced 400*l.*, and himself 600*l.*, to keep the mine in working order.——A vote of thanks to the Chairman closed the proceedings.

PLYNLIMMON MINING COMPANY.

The statutory meeting of shareholders was held at the company's offices, Austinfriars, on Tuesday,

Mr. E. W. WINGROVE in the chair.

The LONDON MANAGER read the notice convening the meeting.

The CHAIRMAN said that this being the statutory meeting they had really very little to report. The company was incorporated on Nov. 2, and out of the 3000 new shares that were to be subscribed for 2000 had been taken. The affairs of the old company were in a fair way of winding up, but there had been some little delay, owing to the solicitor requiring certain legal formalities to be carried out; he hoped, however, that very shortly these would be completed, and the bonus shares issued. The reports from the mine had been published in the *Mining Journal* as received, and the stopes had been yielding about 20 tons per month, which had not quite covered cost. Their latest report stated that in the 24 end east the lode had been cut off by a band of shale, and Capt. Garland is of opinion that they had better not continue further. He is preparing to continue the sinking of the shaft the few feet necessary for the 36 ft. level, and would then commence driving under the rich ground gone down in the 24. Their last report from Captain Garland was dated Feb. 20, and this he would read to them:—

Feb. 20.—Pending the completion of all work connected with the new line of horizontal rods it will not be at all advisable to commence driving a 36 fm. level east of new shaft, as the water, which is considerable, would have to be drawn by manual labour. As previously stated this shaft is now down 11½ fms., and will be required to be deepened at least another 9 ft. previous to commencing another level—the 36. Weather permitting the completion of the requisite surface work shall be carried on, simultaneously with the fixing of shaft-bob, main rods in shaft, and the dropping of a drawing lift, when operations can be resumed at a very considerable reduction in cost, and at the same time a corresponding amount of increased progress can be made. I hope to have everything completed and connected with the pumping wheel in about four or five weeks from date. Respecting the time and distance from shaft at which the 36 may be expected to enter ore ground, I have every reason to come to the conclusion that the level will enter ore ground in about 18 fms. from the shaft, or probably even sooner, as the dip of the strata is inclining westward; hence we may reasonably expect to be opening productive ground in the 36 east in about six months from date, when a continuous run of ore ground should be met with, extending for about 50 fathoms in length. With reference to the pumping machinery and its efficiency, I am pleased in being able to state that the 50-ft. pumping-wheel is in good working order; in fact, it is in my opinion stronger now than when first erected, and with attention thereto, and ample water, it is of sufficient power to put the mine down to any reasonable depth. I can conscientiously state that we have not put a single bolt into it during the past year, neither has it needed any repairs whatever, whereas previous to the putting on of the diagonal stays some kind of repairs were required almost weekly. The manner in which the wheel has kept the mine drained throughout the incessant rains we have had for the past four or five months is sufficient proof of this statement. Respecting propelling power, I have in previous letters advocated the making of reservoirs for the storage of water, but it would, perhaps, be advisable to entertain a proposal we now have for making the engine answer the purpose for which it was intended, providing the engineer undertake the work on favourable terms—*i.e.*, no remedy no pay. I may add that the only thing in favour of the engine is that if made "utile" it will be a valuable asset, whereas any expense incurred in the making of reservoirs will be a dead outlay from which nothing can be derived when the resources of the mine become exhausted in (say) 10, 20, or 50 years hence. The completion of the raising of the embankment of the present reservoir, commenced in May last, should be attended to during the coming summer under any circumstances, as it will be required for the accumulation of additional water for drawing and dressing purposes, and will at the same time lessen the need of steam-power. The requisite works for facilitating the development of the mine at deeper levels shall now be pushed on as fast as possible.—JOHN GARLAND.

The CHAIRMAN remarked that the expense of making the reservoir as proposed would not be more than 50*l.* or 100*l.*, as they only intended to make the walls of the present reservoir higher.

Mr. MURCHISON understood that it was a new reservoir that Capt. Garland proposed.——Mr. KERLY, in reply to a shareholder, said that the next meeting could be held any time within the year.

The CHAIRMAN said they had placed all the information they had before the meeting, and could only say that although they were not making large returns at present Capt. Garland gave them hopes that in a few months they might be making discoveries of ore which would go far to pay cost. As to their financial position, they had plenty of money to go on with for the present, and hoped by the time of the general meeting to have something more satisfactory to report.

The usual complimentary vote of thanks to the Chairman terminated the proceedings.

PRINCE PATRICK MINING COMPANY.

The half-yearly meeting of shareholders was held, on Monday, at the office of the company, Seel-street, Liverpool,

Mr. TIMOTHY HUGHES in the chair.

The notice convening the meeting having been read, Mr. THOMAS HUGHES (the secretary) read the directors' report, as follows:—

In again meeting the shareholders at the close of another half year, the directors regret very much that they are not in a position to place a more favourable balance-sheet before them. The shareholders will recollect that it was arranged at the last general meeting to sink a new shaft to the south of the great south-west lode, it being imperative to do this owing to the bad ventilation, and the great expense attending the then working of that portion of the mine. The sinking of this shaft to the 50 has occupied nearly the whole of the past six months. In a week or two the shaft will be completed, and will no doubt lay open a fine section of ore ground, and afford facilities for the economical development of that part of the mine. The shareholders will perceive by the balance-sheet that the sales of ore for the past six months amount to only 137 tons, realising 2025*l.* 6s. 6d., and after deducting all liabilities to the end of December there remains in hand 916*l.* 13s. 7d. The directors very much regret that they cannot show better results, but the shareholders will bear in mind that the new shaft and other permanent work which it was necessary to complete have cost a large amount in labour, timber, &c. To meet these increased expenses there was only the ore obtained from the stope in the end of the 50 north, on the great south-west lode, as the deeper workings were drowned out in consequence of the long continued wet weather. It was also impossible to work the south end of the great south-west lode for want of proper ventilation. The directors consider that the captain's report so fully explains the value of the lodes and the underground work that it leaves them little to say on that point, and as Capt. Vercoe attends the meeting he will explain on the plans, which he will bring with him for that purpose, the various workings of the mine. In conclusion the directors beg to state that the mine never was in a more efficient state for working than at present, and they feel sanguine that soon after the new shaft is completed they will be in fair way towards a resumption of dividends.

The captain's report was then read:—Capt. H. B. Vercoe says—In concluding this report permit me to say that in Prince Patrick you have a great and valuable property; and, in my opinion, the suspension of dividends is only temporary, and has not arisen through poverty, but solely through a want of energy on the part of the late captain. The exploratory points should have been continuously urged on while the ore ground was rich. Had this been done you would have, as in other great mines, discovered other deposits of ore, while your former one continued to give you good dividends. The points I intend prosecuting are—the 50, north and south from new shaft; the 50, east and west, on the new east and west lode; the 20, north and south, on the north and south lode (No. 2); to continue the present stopes and drivage in the 50, south from Hughes's shaft; and, when dry weather sets in, to cross-cut north in the 60 to prove the great lode. By carrying out these points I confidently believe great discoveries will be made, and the indications they present warrant my asserting that Prince Patrick Mine will produce ore in larger quantities than ever, and correspondingly increased dividends.—P.S. Since writing the above the new shaft is holed to the 50.

The CHAIRMAN said the captain's report, which had just been read, afforded so much information that it really left but little for him to say, and he thought that as the captain was present the best thing would be for him to explain by aid of the plans now before them the various points of interest alluded to in the report.

Mr. GERARD asked how deep the mine had been explored below the 100 yard level?——Capt. VERCOE replied that there were three levels below the 100 yard or 50 fm. level—the 60, the 70, and the 85 fm. levels; and as soon as the dryer season set in work would again be commenced at these points, particularly at the 60 to the north, as he felt certain there existed a new lode in that direction which had not yet been cut into. The captain then explained on the plans the exact position of the lodes, and showed where the new shaft intersected the great south-west lode, and also indicated the other interesting points in the mine.

Mr. HARRIS expressed entire satisfaction with the explanation given by the captain, and he considered that no effort was being spared to develope the mine in the most effective, and at the same time economical, manner.

The CHAIRMAN said that as they had now got the new shaft through, and secured good ventilation as well as a hold of the lode, there was very little doubt that they would soon be able to increase their monthly sales of ore, which he was sorry to say had fallen from 50 tons to 20 tons per month. He believed that before the next half-yearly meeting they would be in a position to declare dividends as heretofore. There had been a great amount of important work carried out during the past six months in the way of repairing and improving the levels, laying tramways, sinking a new shaft, &c., that would enable them for the future to work the mine to greater advantage, and at a saving of at least 20 per cent. in comparison with previous costs. With regard to the statement of accounts, a copy of which had been sent to each shareholder, he had no doubt they were all familiar with the items, and if they were satisfied with the statement he would beg to suggest that one of the shareholders present propose the passing of the accounts and reports.

Mr. HARRIS moved that the accounts and reports as presented be received and passed.

Mr. GERARD seconded the proposition, which was carried unanimously.

The CHAIRMAN suggested that for the future the balance-sheets and statement of accounts be issued annually instead of every six months, but this not to interfere with the holding of the half-yearly meetings.

Mr. ILLINGWORTH moved a proposition to that effect, which was seconded by Mr. COTTON, and carried unanimously.

Mr. WALKER said he felt great pleasure in bearing testimony to the energy and skill of their new captain, who had for the short period since he undertook the agency done wonders towards improving the mine and bringing it into what he believed would soon prove a more profitable state than heretofore. There had been innumerable difficulties to contend with, not the least of which was the strike amongst the miners, and it was a pleasure to find that all these obstacles had been overcome, and that the work was now progressing in a most satisfactory manner. He begged to propose a vote of thanks to Capt. Vercoe.

The vote was unanimously accorded.

In rising to return thanks, Capt. VERCOE said he felt exceedingly gratified at the mark of confidence shown by the vote just passed, and he trusted that this confidence would never be misplaced. His sole aim and desire was to make the mine as remunerative as possible to the shareholders, and he assured them that no effort of his should be spared in order to effect this result. He was working for the future as well as for the present, and he felt confident that the Prince Patrick Mine would soon again be in a dividend-paying state.

Mr. GERARD said he felt much pleasure in proposing a vote of thanks to the Chairman for the manner in which he had presided at the meeting, and for the care and attention he had at all times devoted to the general interests of all concerned.——The vote was seconded by Mr. Illingworth, and carried unanimously.

The meeting then terminated.

CARN BREA MINING COMPANY.

A three-monthly meeting of adventurers was held on Wednesday, at the mine, Capt. TEAGUE presiding.

The accounts showed a balance now against the mine of 3001*l.* The adverse balance at the last account was 2027*l.* The following is the agent's report:—

Highburrow Lode: In the 250, driving east of cross-course winze, the lode is worth for tin 12*l.* per fathom. In the 238, driving west of cross-course winze, the lode is worth for tin 15*l.* per fathom. In the 238, driving east of cross-course winze, the lode is worth for tin 40*l.* per fathom. In the 226, west of cross course winze, the lode continues to be worth for tin 15*l.* per fathom. In the 226, east of Highburrow west shaft, the lode is worth for tin 17*l.* per fathom. This level the Diamond Rock-Boring Company have taken to drive, and will shortly commence operations. In the 226, driving east of Highburrow shaft, the lode is worth for tin 15*l.* per fathom. In Highburrow east shaft, sinking under the 226, the lode is worth for tin 80*l.* per fathom; a more promising lode cannot be seen. In the 213, driving east at Highburrow east shaft, the lode is worth for tin 10*l.* per fathom. In the 213, driving west of Highburrow west shaft, the lode is worth for tin 15*l.* per fathom.

Capt. TEAGUE said that owing to the bad weather which had prevailed during the past three months they were 20 tons of tin short of the usual quantity, and it had realised 2*l.* per ton less than it did in the previous quarter. These things combined had caused the loss on the three months working, stated in the report, which loss was in no degree attributable to any falling off in the mine, the latter having, if anything, improved since the last meeting.

Capt. TEAGUE, in answer to Mr. HALL, stated that the labour cost was from 3*l.* to 4*l.* a month less than it had hitherto been. He wished to draw the attention of the shareholders to the model before them of the diagonal shaft which was being sunk in the centre of Highburrow lode for the purpose of improving the workings by facilitating the carrying away of the stuff. The lode in question was a capital one, and when the shaft was sunk he had no doubt that the position of the mine would be greatly improved.

Mr. HALL asked whether the mine suffered from the effects of water now?

Capt. TEAGUE replied in the negative, remarking that the drawback he had referred to was attributable not only to the recent wet weather but to the short days and the Christmas holidays.

Mr. HALL: You anticipate that during the next three months you will do better?——Capt. TEAGUE: Yes, most certainly.

On the motion of Mr. HALL, seconded by Mr. COCK, the report and statement of accounts were adopted.

Capt. TEAGUE remarked that he had hoped they would have been able to have gone on without making a call, and they would have done so but for the adverse circumstances with which they were acquainted. He thought a call of 1*l.* per share, which would represent 1000*l.*, would be sufficient to meet the loss of the past quarter, and he would propose that such a call be made.——The motion having been carried the meeting terminated.

TINCROFT MINING COMPANY.

The adventurers had their quarterly meeting on Wednesday, Capt. TEAGUE presiding. The accounts showed an available balance of 1555*l.* The agent's report was to the following effect:—

High Burrow Lode: In the engine shaft sinking under the 213 fm. level the lode continues to be large, and yielding low-quality tinstuff. In the 234, driving east of engine-shaft, the lode is worth for tin 12*l.* per fathom. In the 210, driving east of Martin's east shaft, the lode is worth for tin 7*l.* per fathom.—Chapple's Lode: In Downright shaft, sinking under the 246, the lode is worth for tin 25*l.* per fm. In the 246, driving east of Downright shaft, the lode is worth for tin 10*l.* per fm. The lode in the new winze sinking under the 234 is worth for tin 60*l.* per fathom. The 212 fm. level east of shaft is without alteration.—Dunkin's Lode: In the man engine-shaft, sinking under the 170, the lode is yielding good saving work for tin; we have a south part of the lode standing, but this will not be seen for a month or two from this time. In the 170 fm. level, driving west of the man engine-shaft, the lode is worth for tin 12*l.* per fathom. In the 170, driving east of shaft, the lode worth for tin 10*l.* per fathom. In the 160, driving west of shaft, the lode is worth for tin 10*l.* per fathom. The 150 is without alteration since last reported on. In the 140, driving west of shaft, the lode is not looking quite so well. In the 120 fm. level, driving east, the lode is poor. There is no change worthy of remark in any other part of the mine. Our prospects are quite as good as for some time past.

Capt. TEAGUE said the remarks he had made in reference to Carn Brea would apply to this mine also. Owing to the severity of the weather tin had realised something like 30*s.* or 2*l.* per ton less than hitherto, but they did not despair about its again making the old price. (Hear, hear.) Under all the circumstances he thought he was justified in moving that a dividend of 5*s.* per share be declared. This was seconded and carried.

Capt. TEAGUE observed that it was a thousand pities so much tin should be raised with such unsatisfactory results. (Hear, hear.) Should they get an increase in the price of tin the profit, considering the large quantity realised, would be something considerable.

Mr. J. CARTER moved a vote of thanks to the manager and agents, and referred especially to the able manner in which Capt. Teague discharged his duties.

Mr. J. HARRIS seconded this, and it was carried.

Capt. TEAGUE, in acknowledging the compliment, assured the adventurers that he had done the best he could for the mine, and that the agents had all worked with a will to bring about the best results. They might rest satisfied that they should not grow lax in the performance of their duties, and he could only express regret that better results did not attend the exertions made. They had to fight against prices over which they would not command success. He hoped, however, that when they next met it would be under better auspices, and that they would have something to say about the improved state of tin. Unless they did it would be useless to talk of profits in any of the mines.—*Western Daily Mercury.*

COLORADO TERRIBLE LODE MINING COMPANY.

A special general meeting of shareholders will be held on March 9, to submit the following resolutions:—

1.—That the name of the company be changed to The Colorado United Mining Company (Limited), provided that the approval of the Board of Trade be obtained to such change, pursuant to section 13 of the Companies Act, 1862.

2.—That, in pursuance of Article 14 of the Articles of Association, the directors be authorised to increase the capital of the company from 125,000*l.*, the amount mentioned in the Memorandum of Association (but of which 105,000*l.* only has been actually issued), to 325,000*l.*, by the issue of 40,000 new shares, of 5*l.* each, in addition to the 4000 shares remaining unissued of the original capital, as aforesaid. And that the directors be further authorised to allot 40,000 of such new shares to William A. Hamill, of the town of Georgetown, in Clear Creek County and State of Colorado, and Jerome B. Chaffee, of the City of Denver; the shares to be allotted as aforesaid, to be considered as fully paid up, and to be taken by the said William A. Hamill and Jerome B. Chaffee in satisfaction of the purchase moneys agreed to be paid to them for all their mining property on Brown and Sherman Mountains, in the aforesaid Clear Creek County, and all claims and demands in respect thereof. And that the directors be further authorised to dispose of the 4000 shares remaining unallotted of the original capital as they may think fit, for the purpose of providing working capital, without offering the same to the members, as provided in Article 45.

3.—That the regulations of the company contained in the Articles of Association be altered as follows:—

In the heading of the Articles of Association and in the Form of Transfer, set out in Article 21, The Colorado United Mining Company (Limited) to be substituted for The Colorado Terrible Lode Mining Company (Limited), if such change of name shall be approved of by the Board of Trade. In Article 63 the words from "every member" in the first line to the words "25 votes" in line 4 to be omitted, and in lieu thereof the following words to be substituted:—"Every member shall have one vote in respect of every share held by him." In Article 70 the word "eight" to be substituted for "five."

The report states that for many months previous to the general meeting held on June 7, the board had, through the agent and manager—Mr. Henty—and under his advice, carried on negociations with the owners of the extensive mining property adjacent to the Terrible Lode (by one of whom the company had been involved in litigation), with the view of settling the matter in controversy by the acquisition of this property. The board were advised that these mines would form a permanently valuable purchase, and that, altogether apart from the matters at issue, it was desirable that the property should be owned and worked by the company. The terms of settlement which have from time to time been proposed to the directors invariably involved the payment of a large sum in cash, and other conditions which they were unable to recommend the shareholders to adopt. Shortly after the last general meeting the board deputed the secretary—Mr. Andrews—to Colorado. He returned in December, bringing with him an offer for an amalgamation between the company on the one hand and the owners of the property referred to on the other, upon the basis of payment being made entirely in the fully paid up shares of the company, for which purpose it would be necessary to increase the share capital of the company. This offer was duly considered by the board, and while accepted in principle, was referred back to Colorado for certain alterations thought necessary in the interests of the company. A telegram, subsequently confirmed, has arrived accepting these alterations, and the matter has now to be submitted to the shareholders. The property in question includes several hundred feet of the continuation of the Terrible Lode, being that part into which the rich shute or chimney of ore hitherto worked by the company has dipped; also the old Missouri lode, the Chelsea Beach or John Brown lode, the Benton, Tycoon, Glasgow, and U.S. Coin, all proved lodes, and a large extent of promising lodes and claims, the whole being adjacent to the Terrible Mine, and aggregating over 40,000 ft. Owing to their situation in reference to the company's mine and buildings, together with the richness of the ores and the facility with which the united property can be worked as a whole, these mines will not only be a very valuable acquisition, but in the opinion of Mr. Henty, who is one of the

best and most reliable authorities in such matters, will form one of the largest and richest silver mining properties in the world. As the proposed amalgamation involves no payment either in cash or in obligations, the amount of share capital which it is proposed to issue as the consideration for which the property of the vendors will be acquired by the company, must be regarded as representing the relative rather than the actual value of that property. Whatever the actual value may be, the directors have no doubt that it is worth at least twice as much as the property of the company, even if the latter were free from litigation, and that consequently the arrangement is extremely advantageous to the shareholders, while on the other hand the vendors by participating in the advantages of an established English Joint Stock Company may probably hereafter obtain a higher price for their property than they could obtain from any other purchaser. For obvious reasons it would be inexpedient to give more than a short sketch of what is proposed in the form of a circular. Further particulars will be submitted to the meeting, notice of which, together with the resolutions to be taken into consideration, will be found appended hereto. The directors hope that the importance of the occasion will induce a large number of shareholders to attend the meeting, and that all who are resident at a distance, or who may be unable to attend, will be good enough to signify their wishes by signing the enclosed form of proxy, which should be deposited at the company's office 24 hours before the time fixed for the meeting.

VAN RAILWAY.—At the meeting of shareholders on Wednesday the reports and accounts were unanimously adopted, and a dividend of 5 per cent. was declared.

AUSTRALIAN CENTRAL.—At the meeting on Monday the Chairman, Mr. C. Wingrove, declared the resolution passed at the meeting on Feb. 6, "That the directors be and are hereby authorised to further increase the capital of the company by the issue of 2000 shares of 1*l.* each, preferred in respect to the dividend in the same manner as the 12,000 preference shares already issued," to be duly confirmed.

SWEETLAND CREEK GOLD MINES.—An adjourned special meeting was held on Tuesday (Mr. George Batters in the chair), to decide upon the propriety of disposing of the property of the company in America, and winding-up voluntarily. The propositions were well discussed, and in the end a resolution was passed to wind-up voluntarily, and appointing the secretary (Mr. W. J. Lavington) as liquidator. The Chairman stated that he thought the return would be about 8s. per share.

NEW PACIFIC MINING COMPANY.—The adjourned annual meeting of shareholders was held on Thursday. Mr. John J. Courtenay (the chairman) explained that the accounts, for which the meeting was adjourned, were not yet to hand, so that he was unable to lay a balance-sheet before them. The directors had, however, received a message from Mr. Heavan saying that he was pressed for $1000, and in response to a telegram addressed by himself to the late manager, Mr. Pringle, he had ascertained that the existing liabilities of the company in America amounted to about $3250. After the usual routine business had been passed the meeting was constituted as an extraordinary one, for the purpose of considering the financial position of the company; and, after the matter had been well discussed, it was resolved to increase the capital of the company by the issue of 5000 shares of 10s. each, bearing a preferential dividend of 20 per cent., redeemable as the option of the company, at 20s. per share, and being a first charge for principal and interest on the assets of the company in the event of a winding-up. There was a very good opinion at the meeting as to the value of the property, as most of the adjoining and surrounding mines are paying very well. A vote of thanks to the Chairman terminated the proceedings.

GUNNISLAKE (Cliters).—A four-monthly meeting of shareholders was held at the mine: Mr. William Mathews, of Tavistock, in the chair. The Chairman pointed out that their credit balance had been reduced by 30*l.*, from the fact that they had had to charge five months' costs against four months' receipts, not having previously made any arrangement for payment of the thirteen month's cost. It had been expected that they would have had a better price for ore and greater returns, so as to meet this extra month's cost, but the reduction in the standard upset this belief. There had also been additional outlay in working the shaft and for pitwork, but all had been paid for. It was explained, in answer to Mr. Nicholls, that the dues payable under the lease were 1-20th, but the Duchy being very liberal with the company it was not considered a proper time to apply for a decrease. In answer to questions, Capt. Skewis said that money had been wisely expended in developing the mine, and good lodes had been found in consequence. He believed they would open new lodes within the next four months, and that if all the the expectations were realised the value of the mine would be doubled. The Chairman alluded to the fact that a boring machine which had been started at West Maria and Fortescue Mine was doing considerable work, and he thought it might be of use in places where driving was difficult. Capt. Skewis had no doubt that the boring machine at West Maria would be a perfect success, and it was promised that the attention of the committee should be called to the matter with a view to the machine being introduced at Clitters.

Registration of New Companies.

The following joint-stock companies have been duly registered:—

COLORADO MORTGAGE AND INVESTMENT COMPANY OF LONDON (Limited).—Capital 300,000*l.* in 10*l.* shares. To lend money on real and leasehold estates in the United States, and to make advances upon various kinds of securities, and transact other financial business, &c. The subscribers are—J. W. Barclay, M.P., Reform Club and Aberdeen, 250; James Cowan, M.P., St. George's-square, 100; J. J. Courtenay, Plowden Buildings, Temple, barrister; C. Searle-Hayne, 3, Eaton-square, barrister, 100; J. H. Sparks, Belsize Park, shipowner, 100; James Duff, Kingordrum, Forfar, farmer, 100; W. A. Bell, Manliston, Colorado, stock raiser, 100. The directors are Messrs. J. W. Barclay, M.P., James Cowan, M.P., J. J. Courtenay, C. Searle-Haynes, A. G. Renshaw, and J. H. Sparks, the qualification being the holding of 100 shares.

LANCASHIRE AND YORKSHIRE FIRE CLAY WORKS (Limited).—Capital 10,000*l.*, in 5*l.* shares. To acquire for the sum of 500*l.* the estate and interest of Julius Whitehead in the Sandercough Brickworks, Dalesgate, Todmorden, Lancashire, held under lease; also the interest of the said Julius Whitehead in fire-clay works at Southouram-road, Halifax, for 1000*l.* The subscribers are—John Crankshaw, Mocleiffe, Harwich, Lancashire, brickmaker, 10; R. T. Balmer, Angleton, Lancashire, coal merchant, 10; Ellis Boardman, Derby-street, Bolton, contractor, 10; James Hoyle, Turton, Lancashire, inspector, 5; Julius Whitehead, Culver-street, Halifax, 20; L. Crankshaw, Goldschmidt-street, Stockport road, Manchester, wine merchant, 5; W. Pollitt, Poolstreet, Bolton, contractor. The directors are Messrs. John Crankshaw, Joseph Hartley, P. Balmer, Wm. Pollett, R. T. Balmer, and Julius Whitehead, the qualification being the holding of 100 shares.

MANGOTSFIELD PENNANT STONE COMPANY (Limited).—Capital 3000*l.*, in 100*l.* shares. To adopt an agreement made between E. Burges, W. E. Lawrence, and J. R. Shorland, all of Bristol, of the one part, and G. E. Weare on behalf of the company, for the acquisition of 2 acres of land at Mangotsfield, Gloucester, for stone quarrying purposes. The subscribers are—J. Balling, Fielding House, Clifton, 5: H. Amor, 12, Southcot-place, Bath, engineer, 5; James Rowe Shorland, Clyston House, Clifton, builder, 5; Alfred Howell, Weston-super-Mare, gentleman, 6; W. E. Lawrence, 1, Lion Chambers, Bristol, solicitor, 2; E. Burges, 1, Lion Chambers, Bristol, 2; A. Douglas, C.E., Halliford House, Ealing, 2; W. D. Scott, 24, Broad-street, Bristol, draper, 1. The directors are Messrs. John Bolling, J. R. Shorland, W. E. Lawrence, A. Douglas, and A. Howell, the qualification being shares to the value of 100*l.*

BANAGHER WHISKY DISTILLERY (Limited).—Capital 150,000*l.*, in 6000 First Pre-Preference A shares, 3500 Second Preference B shares, 1500 Third Preference C shares, and 4000 Ordinary shares of 10*l.* each. To acquire the business and assets of the Banagher Distillery Company, King's County, Ireland (Limited). The subscribers are—Thomas Cave, M.P., Lancaster Gate, 400; H. Hargreaves, 8, Cleveland square, 500; W. Shillito, 4, The Terrace, Putney, 500; C. J. Todd, 18, Bread-street hill, 100; M. Colclough, 38, King-street, E.C., 500; George Battscock, 5, Carlton-street, Regent street, 10; W. W. Mason, 61, King William street, 250.

INTERNATIONAL FINANCIAL SYNDICATE (Limited).—Capital 500,000*l.*, in 10*l.* shares. To carry on financial business of various kinds. The subscribers are—F. E. Tucker, 25, St. Mary's-road, Peckham, 1; James Wildy, 25, Valentine place, Blackfriars; B. M. Wollam, 52, Queen Victoria-street, accountant; Thomas Agar, 3, Barnard's Inn, Holborn; E. Jones, 3, Barnard's Inn; Anthony Nye, 101, Wyndham-road, Camberwell; G. Abel, Drayton Cottage, South Hackney.

WIRRAL LAND AND INVESTMENT COMPANY (Limited).—Capital 10,000*l.*, in 10*l.* shares. This is a land and building company. The subscribers, who reside at Tranmere, are—Richard Bell, 50; Thomas Hitchnough, 50; James Downham, jun., 50; S. H. Booth, 50; R. Anderson, 50; J. Routledge, 20; W. Taylor, 50.

WATERPROOFING COMPANY—MURATOR'S PATENT—(Limited).—Capital 75,000*l.*, in 5*l.* shares. To acquire a patent invention for waterproofing, &c. The subscribers (who take one share each) are—C. Murator, Clarence Mead, Hackney; J. W. Sully, 23, Gresham House; M. N. Girdlestone, Kirkdale, Sydenham; J. C. Handfield, 9, Bellevue Park, Thornton Heath; T. G. Hughes, 7, Gloucester-road, Peckham; A. W. Sully, 15, Carlyle square; E. D. Pearson, Ealing.

BRISTOL AND WESTERN LAND INVESTMENTT COMPANY (Limited).—Capital 25,000*l.*, in 10*l.* shares. To carry on the general business of a land company. The subscribers (who take one share each) are—C. H. Low, Kildare House, Bristol; G. W. Lucas, Clare-street, Bristol; J. C. Harris, Redlands, Bristol; W. Hain, Oakfield-road, Clifton; J. C. Newman, 19, Portland square, Bristol; J. J. Tifoot, Portland-square, Bristol; T. S. Smith, 50, Clare-street, Bristol.

BUTTERWORTH AND STRINGER (Limited).—Capital 50,000*l.*, in 10*l.* shares. To acquire the business of Messrs. Butterworth and Stringer, of the Rookery Mills, Huddersfield. The subscribers (who take one share each) are—R. H. Butterworth, 2, Somerset terrace, Huddersfield; H. Stringer, Huddersfield; George Haigh, Slaithwaite; Thomas Inglis, Oldham; R. Butterworth, Huddersfield; J. Bentley, Huddersfield; T. Thewlis, Huddersfield.

CEFN AND GARTH STONE COMPANY (Limited).—Capital 5000*l.*, in 10*l.* shares. To acquire from James Stephens the lease of quarries under land at Garth Trevor, Llangollen, Atlas Madoc, Ruabon. The subscribers, who take one share each, are—J. C. Smith, 23, Hawkstead street, Southport, gentleman; Thomas Bushby, Oswestry, manager; J. S. Haigh, 34, Camp stret, Ashton; B. Shand, New Park, Eccles, agent; James Boydell, Halsted terrace, Grantham, traveller; W. Scott, Salford, cornfactor; J. C. Smith, jun., Church-road, Lower Broughton, gentleman. The directors are Messrs. Jas. Stephens, J. C. Smith, and J. E. Page.

HUNWALL TEA COMPANY (Limited).—Capital 50,000*l.*, in 10*l.* shares. To acquire property in the Seebsagur district, Assam, for tea and coffee cultivation purposes; also to work mines, ores, veins, and seams of all descriptions of mineral on the property. The subscribers, who take one share each, are—George Henderson, 7, Mincing lane, merchant; P. Duguid, Auchlunies, near Aberdeen, Esq.; George Henderson, jun., 7, Mincing-lane, merchant; R. E. Henderson, Bunsted, gentleman; J. C. Rogers, 7, Mincing lane, gentleman; P. D. Thomson, 22, Penchurch-street, gentleman; E. C. Dowley, 7, Mincing-lane, clerk. The directors are Messrs. H. Knowles, George Henderson, jun., T. Thomson, and J. P. Jamieson. The purchase consideration for the property is 46,000*l.*

KENSINGTON CATHOLIC PUBLIC SCHOOL (Limited).—Capital 50,000*l.*, in 10*l.* shares. This company's title indicates its object. The subscribers (who take one share each) are—T. J. Capel, D.D., Cedar Villas, Kensington; J. R. Madam, Cedar Villas, Kensington; W. M. Hunnybun, 2, Warwick-road, Earl's-court; A. Lacordaire, Barnes; T. Graham, Principal Training College, Brook Green, W.; E. S. Grindle, 10, Longridge-road, Earl's court; A. J. Capel, 65, Grace-church-street; G. C. Parr, 18, Upper Phillmore-place.

COLNE VALLEY GAS, DRYSALTERY, AND MANUFACTURING COMPANY (Limited).—Capital 40,000*l.*, in 5*l.* shares. To acquire the Colne Valley Gas Company (Limited). The first seven subscribers (who take one share each) are—Wm. Shaw, Mount Pleasant, Longwood; B. B. Hanson, Grove House, Paddick; H. Dyson, Huddersfield; W. D. Shaw, Longwood; J. Fielding, Golcar; E. C. Dyson, Golcar; Richard Eaton, Milnsbridge, Huddersfield.

WILLIAM FOSTER AND COMPANY (Limited).—Capital 60,000*l.*, in 10*l.* shares. To acquire the business, foundry, &c., of the firm of William Foster and Co., engineers, of Lincoln. The first seven subscribers are—D. F. Tonge, Chard, 800; E. Paddison, Ingleby, near Lincoln, 100; H. Greenham, Ketheringham Heath, near Sleaford, 100; C. B. Robson, Bunker's Hill, Lincoln, 100; R. J. Ward, Lincoln, 100; W. Frankish, Lumber Magna, Lincoln, 10; E. F. Sandon, Wellington Foundry, Lincoln, 10.

FLEETWOOD SHIPPING COMPANY (Limited).—Capital 150,000*l.*, in 10*l.* shares. To acquire various ships at the port of Fleetwood, &c. The subscribers (who take one share each) are—Thomas Seed, South Castle street, Liverpool; T. Calvert, West Derby-street, Liverpool; J. G. Seed, Dock-street, Fleetwood; P. Watson, Bury; E. Richardson, Blackburn; G. P. Hartley, Blackburn; W. H. Hargreaves, Over Darwen.

WIGAN SPINNING COMPANY (Limited).—Capital 100,000*l.*, in 25*l.* shares. To carry on business as cotton spinners, at Wigan. The subscribers (who take five shares each) are—E. L. Wright, Wigan; John Stott, Wigan; Thomas Walker, Little Heaton; F. L. Schmidt, Altrincham; Charles Appleton, Wigan; J. Platt, Uttoxeter; T. C. Wright, Lincoln's Inn.

FOREIGN MINING AND METALLURGY.

In the Charleroi district the iron trade remains without animation. The ironworks drift on from day to day, and that is all. Fine plates are in tolerable demand on export account. Upon the whole, it must be said that the position of the blast-furnaces in the Charleroi group is somewhat critical. In the Mons group the iron trade exhibits very little change, and presents no striking feature. The uneasy feeling which exists in reference to the Eastern Question has restricted outlets in the East of Europe, especially as regards rails and railway plant. The great French railway companies have, however, as has been already stated, give out some rather heavy orders for Bessemer steel rails. The German Government, impressed with the sufferings which the working classes of Germany have had to endure of late, has shown a disposition to give an impulse to public works. The works of the Bleyberg and Vivegnis Railway, which have been undertaken by MM. Gouin, of Paris, are to be commenced in April. The works of a line from Battice to Verviers are also being prosecuted with activity, and may be expected to absorb a small quantity of rails and accessories.

A New York correspondent, referring to the operations in railroad bonds in the United States markets, says there has been another great decline in the shares of what are known as the "coal roads," meaning those which connect the great coal fields of Pennsylvania with the great cities of the seaboard. The shares and bonds of these roads were until last August among the favourite investment securities, having paid regularly for many years from 7 to 10 per cent. per annum. The breaking up of combinations to maintain the price of coal has been followed by a decline in the marketable value of these securities to the amount of not less than $150,000,000. Dividends have ceased to be paid upon shares to the amount of about $100,000,000. Coal was never so low in the seaboard towns as now. All efforts towards a new combination to raise the price of coal are defeated, and there seems to be a deliberate purpose among the stronger of these corporations to crush out the weaker. Extraordinary efforts have been made to prevent the entire sacrifice of the stock of the New Jersey Central Railroad, but without success. It is thought that when the ruin of that corporation is completed a new combination and a recovery of values may be expected.

The production of bricks will commence in Belgium as soon as some fine spring weather sets in, and already Belgian colliery proprietors are endeavouring to obtain orders from brick burners. Although brickmaking is an industry of some importance in Belgium and the North of France, it does not lead to the consumption of a very large quantity of coal, but at present Belgian coalowners are neglecting no opportunities for developing business. The German colliery owners are also endeavouring to force business in Belgium; one powerful colliery company beyond the Rhine grants, for instance, a commission of 2*s.* to its Belgian agent for every ton sold by him. This would appear to show that German colliery proprietors are endeavouring to dispose of the heavy stocks with which they are at present encumbered without much regard to the profits which they may realise in doing so. *Apropos* of German matters, it may be added that a rather important adjudication for Bessemer steel rails is about to take place at Berlin—9250 tons for the Berlin and Wetzler Railway.

Coal appears to be rather tending downwards in price upon the French markets. The demand does not increase; on the contrary, it is, if anything, still falling off. In the Pas-de-Calais, where coal mining is still a comparatively young industry, coalowners have occupied the present period of depression by devoting themselves to exploratory works upon a large scale. The Loire basin has been subject to less violent oscillations in prices, as it has been supported by a pretty good local demand, but the development of the small basins of the South, the Centre, and the West of France has been checked by the recent course of events. One discouraging circumstances in connection with the French coal trade is the little inclination evinced by capitalists at present to engage in mining pursuits. The coal trade has remained weak at Paris.

In connection with the French iron trade it must be observed that the situation scarcely improves, upon the whole. The large order—or rather the large series of orders—for steel rails given out by the Western of France Railway Company has been shared as follows:—Chamond, 30,000 tons; Creusot, 20,000 tons; Terrenoire, 15,000 tons; Fourchambault, 25,000 tons; Terrenoire, 15,000 tons; and Creusot, 15,000 tons. St. Chamond is to make deliveries between 1877 and 1880; Creusot, Terrenoire, and Fourchambault are to fulfil their contracts between 1878 and 1880; and Terrenoire are to deliver their second lots in 1881. The contract prices range between 8*l.* 12*s.* and 9*l.* 3*s.* 3*d.* per ton, delivered at Batignolles. These amended details differ slightly from those given last week. The lowest price is attached to the deliveries to be made by Terrenoire and Creusot in 1881. The Paris iron market has been pretty well supported, but prices have not advanced; a quotation of 7*l.* 12*s.* per ton is the average rate current for merchants' iron. In the Franche-Comté and in the Haute-Marne there are complaints of floods having impeded the operations of certain works. Small descriptions of iron are in more demand than heavy articles. Pig has not varied in price; the blast-furnaces in the East of France are still threatened by the competition of the Luxembourg. Good refining pig is quoted in the Meurthe-et-Moselle at 2*l.* 8*s.* 10*d.* per ton.

The Paris copper market has remained without animation, but prices have slightly advanced. In Germany transactions in copper have continued to be restricted to the requirements of consumption. There has been little doing in tin at Paris, and prices have remained without variation. At Rotterdam there has not been much business doing in tin, but prices have been fairly maintained. The German tin markets have presented little interest. The French and German lead markets have shown little change. A very similar report may be made with regard to zinc.

HYDRAULIC GOLD MINES OF CALIFORNIA—IMPORTANT DECISION.—The Nevada Daily Transcript says the decision in the case tried in the District Court, in Sacremento County, between a farmer of that county and the Amador Canal Company, for damage done his land by the tailings which were spread over it by the mining company mentioned, is one of great interest to our people, as it affects the principal industry of the county. In the case mentioned the farmer obtained a verdict of $4000 for damages done his property by the deposit of tailings from the mine above. If we understand the case correctly, the land injured was in close proximity to the mine, so that there was no question where the sediment came from. The land injured was not situated like that along the banks of the Feather, Sacramento, and other rivers, 40 or 50 miles below the mines. The ground in dispute was, in short, used as a dump. It was the same as if a miner should run his water so as to deposit all the debris from his claims directly upon the garden of some resident below instead of into a regular stream capable of carrying it away. In such a case, even among miners, damages would be paid without question. All the miners of this county deposit their debris into streams, which carry it away, and the damage to lands, if any is done, occurs many miles down the streams. Judge Sexton in the case charged the jury, among other things, that "if defendant in the usual and ordinary working of mines discharged mud or tailings upon the banks of the creek at places remote from plaintiff's lands, and such matter found its way into the natural course down the creek, and portions of it were deposited on plaintiff's land, defendant would not be liable to damage, but if the deposit was carried directly upon the land by the water used in the mine, or if the sediment were deposited in such proximity to the land that it must of necessity pass on to it the defendant would be liable for all damage." From this we infer that there is not much of a chance for a fight between the miners of our county and the ranchers.

SUCCESSFUL HYDRAULIC MINING.—The American Mine, below San Juan, has been a good producer, and has gold enough in it yet to make the owners regular "muldoons." From 1863 to 1872 the company's books show that $1,241,240 was taken out. It is one of the best and most economically worked mines in the county. A tunnel was commenced about eight years ago, and was completed last year. It is 400 ft. in length, and will permit all the ground to be washed through it. There is ground enough to last ten or fifteen years. The mine has the most complete system of underc rrents to be found in the State, and but little gold is allowed to escape. We believe there are over 40 of these gold savers between the mine and the creek. The owners are John McCoy, J. S. McBride, George C. Spooner, S. M. Crall, A. B. Swan, J. M. Dickson, Furth Brothers, and others. They are all first-class men, and deserve the prosperity they are all enjoying.

THE MECHANICS OF ENGINEERING.

The thoroughly popular character of Weisbach's Mechanics has long been widely known and appreciated, more than thirty years having elapsed since the first edition was published, and of the English translations none better can be desired than that of Mr. Eckley B. Coxe, M.E., a new edition* of which has just been published by Messrs. Trübner. The great recommendation of Weisbach's Manual is that, whilst all that it is absolutely necessary for the engineer or other professional man to know is given with care and judgment, it is made available to those who have not had the advantage of a complete technical training; for, as he remarks, his principal effort has been to obtain the greatest simplicity in enunciation and demonstration, and to treat all the important laws in their practical applications without the aid of the higher mathematics. Considering how many subjects a technical man must master in order to accomplish anything very important in his profession, it should be the business of teachers and authors for technical men to facilitate the thorough study of science by simplicity of diction, by removing whatever may be unnecessary, and by employing the best known and most practical methods. Although at the present time the opportunities for acquiring a knowledge of the calculus are no longer rare, yet it is an undeniable fact that unless we are constantly making use of it we soon lose that facility of calculation which is indispensable; for this reason so many able engineers can no longer apply the calculus which they learned in their youth.

The fourth edition has undergone no change in arrangement—in deed, as the translation of the previous editions into English, Swedish, Polish, and Russian gave sufficient evidence of the value attached to the work, modification would scarcely have been justifiable—but the endeavour was made to remove any errors or omissions that may have been observed, and to introduce the results of the latest practically important experiments, together with the newest developments of theory. Thus in the chapter upon friction he has included the results of the latest experiments of Bochet, and the section upon elasticity and strength has been re-written in accordance with the present standpoint of science, in doing which he has made use of the latest works of Lamé, Rankine, Bresse, and others. The section upon hydraulics has been augmented, improved, and completed, and there are also embodied Weisbach's later researches, particularly his experiments upon the efflux of water under great and very great pressures, as well as upon the heights of jets, those upon the efflux of air, and the comparative experiments upon the impact of streams of air and water. The several chapters of the work treat of phoronomics, or the purely mechanical theory of motion; mechanics, or the physical science of motion in general; the statics of rigid bodies; the application of statics to the elasticity and strength of bodies; the dynamics of rigid bodies; the statics of fluids, and the dynamics of fluids; whilst the theory of oscillation is given in an appendix. In order to render the work as complete as possible, Mr. Coxe has added an appendix, giving the result of the various researches of Weisbach since the German edition was published, and these include the experiments with the efflux of water under a very small head, and outlines of the various papers which Weisbach has published in the technical publications of Germany.

The volume is one which should be carefully and thoughtfully studied by everyone aspiring to a prominent position in the engineering or any allied profession, for from the manner in which the information is given the whole of the facts and hypotheses necessary to be known can be learned and readily stored in the memory.

* "A Manual of the Mechanics of Engineering, and of the Construction of Machines." By JULIUS WEISBACH, Ph.D., Oberbergrath and Professor at the Royal Mining Academy at Freiberg. Vol. I. Theoretical Mechanics. Translated from the fourth augmented and improved German edition, by Eckley B. Coxe, A.M., M.E. London: Trübner and Co., Ludgate Hill.

METAL WORK.—The first part of a handsome work on art industry—"Metal Work," edited by Mr. G. W. YAPP, assistant-commissioner and compiler of the Official Catalogue of 1851—has just been published by Messrs. Virtue and Co. It is to be completed in 20 parts, and will be illustrated with about 1200 plates. If the quality of workmanship displayed in the specimen number be continued throughout the work it will form a very handsome book for the drawing-room table. The part contains an engraving, about 8 in. by 6 in., of the celebrated Milton Shield, executed by Morel Ladeuil, at present in the South Kensington Museum; and others of the specimens by Antoine Vechte, exhibited in 1851; of French gold work by Mellerio Frères; of French silver work; of Prussian and English repoussé work; of English ironwork; of modern mediæval metal work; of gas fittings, bronze, and iron castings. The volume is intended to be a book of reference for artists, art workmen, and manufacturers, and promises to be a very useful one.

LEVER'S MINING ALMANAC.—The edition for 1877 of this almanac contains in addition to the usual calender matter, names, addresses, and lists of officers of the principal societies connected with the coal and iron trades, and a summary of the last published mineral statistics of the kingdom. Mr. Lever's name is well known as the manufacturer of non inflammable brattice for collieries, and the accident at Farnworth has directed renewed attention to its use. It is customary to use cloth, commonly a sort of tarpaulin, to form part tions in various roads or passages of the mine, to split the air or promote a current in any drift which is not, so to speak, a thoroughfare. It needs but little knowledge of the material to be aware that it will take fire like dry straw, and a roll of the cloth would be almost equal to a tar barrel for a bonfire. This is the brattice-cloth so often referred to in colliery accidents. In the fatal accident at Stonehill Colliery this bratticing took fire. There is no doubt about the person whose candle was the immediate cause of the fire, but there was much conflicting evidence on the question whether the brattice was fired direct by the candle, or some gas flashed at the light and set fire to the cloth. For some years past Mr. Lever has been making a cloth which after being well saturated with tar so as to make it a sound brattice-cloth is treated with a salt which renders it uninflammable. As it is understood that the cost of the safety brattice is little, if any, more than that which has led to so many accidents, it is much to be regretted that the use of the safety cloth is not universal.

PRACTICAL DICTIONARY OF MECHANICS.—The reception which Knight's "Practical Dictionary of Mechanics" has had in the United States is of itself a sufficient justification for its reproduction in this country; and the admirable style in which it has been issued by Messrs. Cassell, Petter, and Galpin will certainly ensure it a large circulation. The issue of the work in cheap monthly parts will place it well within the reach of those to whom it will be useful; and in this category will be included technical students of every class. A more competent author for such a work than Mr. Knight could scarcely have been found, since he has for many years been engaged in editing the United States Patent Office Reports, and classifying patents, and systematising for official examination the 20,000 applications for patents yearly presented to the office. The scope of the Dictionary embraces agricultural machinery, wood, metal, glass, stone, clay, cement, and leather working; mining, hydraulic, railway, marine, and military engineering; working in cotton, wool, silk, flax, hemp, and paper; steam, air, and gas engines, and other motors; lighting, heating, drying, and ventilating; fine arts; photographic, electric, telegraphic, optical, horological, calculating, surgical, and dental instruments, and other subjects. Each subject is considered in its alphabetical order, and each art, trade, or special manufacture has its own particular index, under which are assembled the various terms and names of tools, machines, and processes of the trade. By consulting this index a subject may be found by searching among its congeners when a name is imperfectly known, or has temporarily slipped the memory. About 15,000 words have been thus gathered into over 150 specific indices, which themselves occur in their alphabetical places. The work is one which every technical workman should possess, and the present mode of issue will enable him to obtain it.

HOLLOWAY'S OINTMENT AND PILLS—SORES, WOUNDS, AND ULCERS.—Every variety of sore, ulcer, eruption, boil, and carbuncle is safely stopped in its destructive course by the timely application of this healing ointment. It arrests unhealthy and substitutes healthy action, thus curing the inflamed, irritable, and spreading diseases affecting the skin. Holloway's ointment has gained an imperishable fame for its facility in healing old inflammatory sores about the shins and ankles, and for bad legs and old wounds it cannot be equalled; nor is it less efficacious in gathered breasts and abscesses. When the complaint has been of long continuance, Holloway's pills will expedite recovery if taken in those doses which act as alteratives on the stomach and tonics on the constitution.

THE WORTH OF WAGES.

There can be little doubt that a thorough appreciation of the relation between work and wages would be of equal advantage to masters and workmen, and Mr. WILLIAM DENNY'S pamphlet (Dumbarton: Bennett Brothers) on the Worth of Wages sets forth the whole matter so clearly that it should be closely studied by all classes. Mr. Denny points out that besides the purely economical aspect of this great question there are several others which must be considered before any thorough grasp can be obtained of it. There is the historical view explaining the permanence of a class spirit which has done much to complicate and embitter labour disputes. There is the view of the labour question taken by socialists, the fruit of some of the unscientific, and any metaphysical speculation of last century. And besides these there are many other greater or lesser considerations deserving of remark, and notably the action and result of Trades Unionism as exemplified within our own century. Regarding co-operative production Mr. Denny remarks that there are those who take a less hopeful, and those who take a more hopeful, view of the matter than himself. For his own part he does not think it very near realisation on any great scale, yet he is so impressed with the skill and ability shown by our workmen under piece-work, and their admirable organisation, that he cannot but feel that some day it will come in a more or less modified form. At the present moment some of these men do everything in their own special departments except purchase the raw material, and their whole work is an education of the very best kind in every consideration of the adaptation of means to ends in the use of machinery, and in the economy and sub-division of labour. There are, of course, excellent and honest time workmen to be found, but the mass is inherently unprogressive, and the more energetic sprits rather incline to the policy of the degradation of labour than to any consideration of how its efficiency is to be increased. Such co-operative producing companies as exist confirm the opinion that their great extension and success will ultimately be due rather to piece-workers than time-workers, for such of them as have succeeded when begun on time-work have been so small as to exemplify the state of time wages under the old condition of easy supervision, and where their effect came nearer to piece-work. Industrial co-partnerships, he continues, have been much praised, and are by some people confused with co-operative production. To him they seem utterly hopeless, and they have certainly so far not been successful. They contain the germ of the old dispute of how much the workman is to get, and how much the master; and the contest over this is simply transferred from the trade in general to the firm in particular. The true solution of the question seems to lie in the workmen fitting themselves for co operative production, and in accepting the training of piece-work, which is most likely to make them efficient; in fact, in educating themselves in their work individually and competitively. This is the only road in the larger trades which can lead them towards super-seding their masters, or rather becoming their own masters. This they have a perfect right to do, and may do if only they become sufficiently prudent, skilful, and self-sacrificing. Mere discontent and restriction of trade will keep them workmen and nothing else to the end. The other and freer course will lead them to a more prosperous future, and that without in any way injuring the prosperity of this great country, which it should be our duty and happiness to cherish and increase.

The worth of wages is defined to be the amount of work produced for a certain amount of money paid, and there is no other measure of value for wages which is of more than temporary and local utility. This is a fundamental truth, and however it may be obscured by class feeling and the technical difficulties of paying for work it stands forth as the only true measure of the relationship between work and wages. When manufactured articles come to market competition settles their price, which price in the long run indexibly searches down to the roots of production. This competition does not enquire of the workman how much he has per hour or per week, or even how many hours he works, it simply asks how much of the cost of this article fell to his labour. In the same way it demands of the seller of the raw material how much he was paid for it, and of the manufacturer how largely his costs of management, charges, and profits, bulked in the cost. There is no escaping this searching inquisition. It sifts the costs of production to the last grain, and ultimately, in masses or individually, sweeps away the unsuitable producer, manufacturer, or workman. We may turn as we please, and rail against the inflexible action of this kind of power; we are merely beating the air, and beating it uselessly. The greatest men in this world have come to know that they, and they alone, were not the arbiters of their own, their country's, or the world's fate. And as they recognised this so did they rise above the large masses, who, strong in their vanity of man, have extolled his power to do all and reach all. Workmen and employers frequently err in their non-recognition of this truth, and delude themselves with the fancy that they can raise or depress wages by their power and at their will. Apparent successes blind their eyes from seeing that, sooner or later, the balance is righted, and at their cost.

Political economists say that the increase of capital in any country means the increase of the wages fund; but, as Mr. Denny points out, we know that other countries can compete for this capital or wages fund, and as a matter of fact the larger portion is absorbed either directly in remunerating foreign labour or indirectly in opening up and developing countries to such an extent as will render them ultimately capable of competing with us in our great manufactures. This is a very subtle and almost unnoticed feature of foreign competition, but it is one which the interest of every workman should lead him to study with wisdom and calmness, for it is a competition which doubles his losses against him in one and the same action, carrying away part of his wages fund and bestowing it upon his foreign competitor. He marvels exceedingly that our workmen have never seen this, and have never realised that in this aspect of the labour question they are not really one iota superior to their employers, but only, like them, competitors for a capital fund existing and increasing in the world, but no one-sided divinity purposed for their exclusive enjoyment. Temporary conditions often hide from men the true circumstances of their lives, and there is no class of men who have until lately had so much hidden from them as our workmen. Many of them are now beginning to think for themselves, and to think shrewdly too; but there is still among the great mass far too little individuality. This will be better by-and-bye, and we should believe in our workmen, for they are of the same nature and stock as the great engineers, contractors, business men, and traders of our country, and it is quite absurd to think that great possibilities are not dormant in them. The day will come when, their present ignorance and prejudices removed, and their one-sided advisers discredited, the workmen of this country will rise up out of the silly theoretic dream they are now indulging, and will show foreign competitors that a strong arm and a skilful ready brain will be turned against them on every field they attempt to take from us. This will come, but not immediately, and we may lose much in the transition. The sooner, however, our workmen grasp the larger truths of their position the less will be the loss.

Throughout the pamphlet Mr. Denny displays an acquaintance with all the bearings of the question, upon which he may well be congratulated, and if his explanation suffice to convice workmen that both the masters and themselves are dependent for their wages and profits upon the state of matters existing in other centres of production, and altogether beyond their control, he will have conferred a lasting benefit upon all concerned. All our workmen have a dead level fight waged against them by the labour of the outside world. This outside labour is surely and certainly weighed against theirs in the long run, and there is no other way in which they will ever rise above their external rivals but by displaying a skill and power beyond what these rivals possess. Now, our workmen not only do not see this, but have, taking the great majority, been pursuing a policy which is directly contrary to their success, and that policy Mr. Denny designates as the policy of "the dégradation of labour; or, in other words, the policy of reducing by every means the individual output of work. A free competition, he observes, between workmen must come before we shall be secure against the competition of foreign labour. The masters have long competed against each other severely, yet some have made fortunes at prices and conditions which ruin others; but any estimate upon this must be based upon the average profit of the masters in any one trade employing workmen, and it will then be found that the profit received is on the average such that if it fell much there would simply be a desertion of the trade, and a consequent glut of its workmen, who would go to the wall at once. The poor and speculative master does more to raise wages than all the Trades Unions in the kingdom can do. How Trades Unions fail to see this it is difficult to understand. The more new masters are tempted into a trade the greater is the chance of a rise of wages, for the more employers there are seeking workmen, but capitalists are not tempted to invest their capital in anything that is losing money. It is, therefore, no ultimate gain for a workman that his master loses money, but much the reverse.

The objections of some workmen, usually the least honest and industrious, against payment by results are very ably met by Mr. Denny. The main objection to it, in the eyes of a thorough Trades Unionist, is that it is the direct reverse of the policy of the degeneration of labour; its purpose and results are the increased efficiency and a decreased cost of labour as measured by the production of any article. He urges that we come near the truth by saying that a workman under piecework generally increases his output in the long run, partly by working hard, but principally by exercising more intelligence, and arranging his work better, by about 75 per cent., while the total amount of his wages increases by about 50 per cent., making a direct saving on the wages portion of the cost of the given article of about 14 per cent., a saving which, as has been already pointed out, the competition of the masters generally hands over in greatest part to the buyer or consumer, much against the masters' will of course. We may here remark the absolute necessity of piecework in the conduct of expensive tools, such as are used more in engine-works than in building-yards. There the stupidity and obstinacy of a single workman may greatly decrease the output of some expensive and important machine. Piece-work would, perhaps, double this output, and thereby make the capital employed equal to twice its value. Men would find numerous ways of saving, not only in the actual work, but in the shifting and adjusting of the pieces treated, and in the sharpening and use of their tools, which would, on the whole, nearly double the output of their machines. For work of this kind very high rates could be paid, with a direct and marked saving to the employer.

This is the aspect of piece-work as it concerns the master and the public. As regards the workman, we have to consider that the increase of from 25 to 50 per cent. in his wages, and this increase Mr. Denny's experience confirms as the rule, puts at once within his power a more comfortable and easy style of living, combined with an opportunity of saving which, if he is a sober and careful man, will permit to enjoy a pleasant old age, and even to lay by sufficient money to enable him to refuse on his own account any rate of payment which he deems insufficient.

In conclusion, he urges that the pressing solution of some of our principal difficulties as a manufacturing nation lies in the abolition of day's wages, and in the change of the system of paying wages to the logical and consistent basis of payment by results. Many of our workmen will struggle blindly and foolishly against this, but their eyes will open to wisdom and the truth at last. They are of too good stuff to be unwise for ever, and when they do awake you may be sure they will carry forward our country's commercial prosperity unshaken and unconquered in the face of all the world.

TECHNICAL EDUCATION IN JAPAN.

TOKIO KAISEI-GAKKO.

The marvellous progress which has during the past few years been made by the Japanese in the study of occidental arts and sciences has frequently called forth expressions of surprise and admiration, and the liberal constitution and great success of the Tokio Kaisei-Gakko, or Imperial University of Tokio can leave no doubt as to this progress continuing. The Yogaku Sho, or Institute of Western Knowledge, out of which the Kaisei-Gakko has sprung, was founded under the Government of the Tokugawa family at Kudan Zaka Iida Machi; it was opened for instruction in January, 1857, under Koga-Kinichiro as principal, Sugita-Seikei, Mitsukuri-Gempo, and others as teachers. The only foreign language at first taught was the Dutch, but English and French were added at an early period. After several temporary removals the school was finally located in 1862 at Gojinga Hara, Hitotsubashi-Gomon Soto, where the buildings, now occupied by the Foreign Language school, were erected for its accommodation. During the revolution in 1868 the school was closed, but in the September it was again opened by the present Government under the charge of Kawakatsu-Omi and Yanagawa-Shunzo as directors, who were soon succeeded by Matsuoka-Shichisuke and Uchida-Tsunejiro. In 1869 Mr. Pousset was employed as teacher of French and Mr. Parry of English. In 1870 the Central Government marked its appreciation of higher learning by directing each provincial Government to send one or more eligible pupils to be educated at the Kaisei-Gakko. Important changes were from time to time made, systematic courses of study were established, and additional branches were introduced. In March, 1872, His Imperial Majesty, the Tenno, paid a visit to the establishment, and as this was the first occasion of the kind in the history of the empire, it was justly regarded as the beginning of a new era in the progress of education in which the Head of the Nation was to take the education of his people under is special care.

The progress of the pupils during the past years had, in April, 1873, brought them to a point where the facilities for a higher education were required. Accordingly, provision was made for instruction in several departments of special and technical learning; courses of study were, therefore, projected in law, chemical technology, engineering, polytechnic science, and mining. The advanced departments were opened by the Tenno in October of the same year, and from that time alone constituted the Kaisei-Gakko, the old building continuing to be occupied by the lower classes, which thenceforward were organised into a Foreign Language School, arranged to comprise departments in the English, French, German, and Chinese languages. The present director, Hatakeyama-Yoshimari, was installed in December, 1873; in February, 1874, Dr. David Murray, the Foreign Superintendent of Educational Affairs in the Department of Education, was appointed also Director of Instruction in the Kaisei-Gakko; and in October of the same year Hamas-Arata was appointed Vice-Director under Hatakeyama-Yoshinari. In June, 1875, 11 students were chosen from the highest classes in the institution, according to the relative grades at the previous examination to be sent to pursue their studies in foreign countries. They have since entered professional and technical schools for the purpose of continuing their special studies already begun. Four are studying law, three chemical technology, two engineering, one mining, and one a polytechnic course. With a view to economy, the Department of Education, in June, 1873, announced its determination to employ ultimately only one foreign language for the purposes of higher education in the Kaisei-Gakko, and to confine instruction in the others to the schools of foreign languages. From September, 1875, students designing to pursue higher special and professional branches of study have only been admitted into the English department.

The general course in the English department embraces physics, taught by Prof. Veeder; natural history and Latin, Prof. McCartee; English literature, Prof. Summers; mathematics, Profs. Parson and Wilson; history, Prof. Syle; English language, Professor Allin; mineralogy and geology, Prof. Munroe, an esteemed correspondent of the *Mining Journal*, assisted by Nakano-Toshio; general chemistry, Prof. Rockwell, assisted by Yamaoka-Jiro; and drawing, Prof. Wasson, assisted by Yamaoki-Nariaki and Kamo-Tomonobu. Prof. Atkinson teaches analytical and applied chemistry in the special course in chemical technology, Masaki-Taizo assisting in the laboratory, and in the same department Prof. Munroe teaches geology and mining, and Koga-Moritaro French, with special reference to its use in scientific studies. The studies in the Japanese technical department are all in the Japanese language, and embrace a course in chemical arts and a course in mechanical arts. In this, arts and manufactures are taught by Prof. von Wagener, physics and chemistry by Hiraoka-Morisaburo and Kumazawa Zennan, the theory and practice of machines by Osada-Ginzo, mathematics by Oyeno-Tsugumitsu and Yegi-Chiuki, and practical chemistry by Shoji-Ikki and Shimoaki-Motojiro. The student having satisfactorily finished his studies by completing either the general or a special course, is authorised to present himself before a board of examiners appointed by the Minister of Education, and if he satisfies the examiners he receives his degree. The Department of Education has established three academic degrees to be bestowed with its sanction and authority—Tokugiyoshi, or bachelor; Gakushi, or magister; and Hakushi, or doctor; the student becoming Horitsu-Tokugiyoshi, LL.B.; Gakujiutsu-Tokugiyoshi, B.Sc., and so on, according to the courses of study he has completed, whilst those who particularly distinguish themselves are granted a loan by the Government to enable them to pursue their studies in foreign countries.

The Kaisei-Gakko has an abundance of educational apparatus, ample collections of minerals, and an excellent reference library of over 18,000 volumes. In Prof. Munroe's classes crystallography, as an introduction to mineralogy, is taught, with the aid of a large collection of crystal models in wood and glass, special care being taken to enable the student to recognise the compound, hemihedral, and distorted forms more commonly met with in nature. This is followed the same half-year by elementary descriptive mineralogy, the student learning the chemical composition, physical properties, mode of occurrence, and uses of the more common and useful minerals, and familiarising himself with their external appearance by study of the specimens in the college collections. Over 1000 specimens are always accessible, and can be freely handled by the students, whilst the main collection of over 4000 specimens under glass is open to their inspection. The course is thoroughly practical, and the system of instruction ingenious. The student is required to recognise and name from external appearance alone, or with the aid of a few answers from the professor, as to physical or characteristic chemical properties. In the first half of the junior year the students of the chemical and engineering courses continue the same subject, study the rarer minerals, and the student has now to determine the physical properties for himself. In geology the technical details given in the text book are supplemented by lectures introducing illustrations drawn from the geology of Japan. The course includes the theory of mineral veins, description of the mode of occurrence of the useful and precious metals, and a review of the most important deposits of different countries. In like manner is shown the geological relations of the fossil fuels, petroleum, porcelain, and brick clays, building stones, limestones, and other useful rock and minerals. The more important deposits of Japan are described in their proper place, and compared with those of other parts of the world, the lectures being illustrated by a special collection of useful rocks and minerals from Europe, America, and different parts of Japan.

The lectures in mining follow in course those on economic geology, and includes detailed description of Japanese methods of mining compared with the theory and practice of other countries. The methods of prospecting, with the rules which should govern such work, and the best method of conducting reconnaisances and detailed surveys of mineral properties, are described at length. Then follow the methods of opening mines, including preliminary operations. Details are given of the different plans of underground work suited to different conditions, including the manner of ventilating, transporting and hoisting materials, draining and pumping mine water, &c. The lectures are illustrated by a large collection of mining models, showing shafts, stopes, &c., with their timbers, hoisting and pumping machinery, cars, tramway, mining tools, &c., the students being required during the vacation to visit mines or smelting works, and draw up a written report of their travels, and submit it to the professor, thus imitating the system which has proved so valuable at the celebrated School of Mines connected with Columbia College, New York The metallurgical course may be regarded as a continuation of the mining course of the previous year. The lectures teach the mechanical preparation of ores, the use and manufacture of fuels, the construction of furnaces, &c. Following these are lectures on metallurgy proper, the smelting of ores, and production of metals. The processes in use in Japan, both native and imported, are described in detail, and throughout the course particular attention is directed to those methods which are best suited to the conditions which obtain in that country. The lectures are illustrated by a large collection of models, furnaces, and ore-dressing machinery, and specimens of ores, fluxes, fuels, and metallurgical products from different parts of Japan, Europe, and America. There are, likewise, courses of mechanical and civil engineering, under Profs. Smith and Wasson respectively; a natural history class under Prof. McCarte, and the utmost possible facilities are offered for the study of law, political economy, natural history, and various other sciences which have been so thoughtfully studied in Europe, so that the Japanese can very fairly claim that they have taken all the necessary steps for engrafting the knowledge of the Western nations upon that of their own, and from the number of students pursuing their studies in the Kaisei-Gakko it is evident that the facilities which the Government has thus offered are very widely appreciated.

THE PORCELAIN AND PORCELAIN MINERALS OF JAPAN.

An elaborate and interesting report upon the porcelain and porcelain minerals from Japan exhibited at the recent Centennial Exhibition has been made by Dr. H. WURTZ, of Hoboken, assisted as to the microscopic observations and literature of the subject by Mr. A. A. JULIEN, of the Columbia College School of Mines, New York. In connection with the resources of Japan, Prof. Munroe, of the Tokio Kaisei-Gakko, remarks that the mineral wealth of Japan lies not, as was formerly supposed, in inexhaustible deposits of the precious metals, but chiefly in its abundant stores of coal and iron. Next in importance, perhaps, to coal and iron are the porcelain clays, which form the basis of a very considerable industry. Minerals used for pottery of all kinds are very abundant in Japan. This is the case in a most remarkable degree in the neighbourhood of Arita, in the province of Hizen, which is the centre of the porcelain manufacture. The raw material is always powdered by means of balancing pounders of peculiar construction. No machinery equivalent to the quartz or glaze mills of foreign countries is used, so that all that cannot be pounded sufficiently fine by the process mentioned (often 40 to 50 per cent.) is thrown aside as waste. Long experience, combined with the good quality of the raw material, enables the manufacturers to prepare a clay fit even for the production of very large pieces, such as vases from 6 ft. to 7 ft. in height. The throwing and shaping of the clay is done upon the common potter's wheel, by means of which the workmen of Arita turn out large dishes of 3 ft. diameter, as well as the so-called egg-shell porcelain, not thicker than paper. When the pieces have been sufficiently dried in the open air they are shaped with sharp iron tools on the same lathe on which the first throwing has been done, and are then coated with a very pure white clay, so as to give the finished ware a better appearance, and to bring out with more intensity the fine blue colour of the cobalt painting.

The Tsuji-chuchi is the best and whitest clay, and at the same time the most refractory, not vitrifying so easily; for this reason it is not used alone, but is mixed with a certain proportion of less refractory shiro or sakaime-chuchi, even when compounding the body of the thin egg-shell ware, so that the mass may vitrify in the same fire as the layer and thicker pieces made of the two latter minerals alone. An absolute analysis of tsuji-chuchi, washed and dried over oil of vitriol gave—combined water, 2·518; silica, 78·181; alumina, 15·699; Ferrous oxide, 0·663; lime, none; magnesia, 0·099; soda, 1·744; potash, 0·551; manganese, trace = 99·430. The uwa-kuszuri-chuchi, used in compounding glazes in admixture with lixiviated wood ashes, gave upon analyses rather less alumina; the magnesia was replaced by the same percentage of lime, magnesia being absent, and the manganese was replaced by sulphur. There was also nearly 1¼ per cent. more combined water. The report, for the advance sheets of which we are indebted to the American chemist, contains a vast amount of information of value to porcelain manufacturers, and is not without interest to those sending porcelain clay to market. The engraving representing Dr. Julien's microscopic observations are very important, and the entire report shows that Dr. Wurtz has not only bestowed a large amount of his own labour upon its pro-

duction, but that he has freely availed himself of the assistance of others, when that assistance was likely to render it more useful.

SOLID EMERY WHEELS.

For some years past the solid emery wheels of the Tanite Company of Stroudsburg, Pennsylvania, have enjoyed a high reputation in America, and have now come to be regarded as an indispensable portion of the machine-tool plant in every large workshop, so that it is not surprising that it should now be proposed to introduce them extensively into this country. Many of the statements made are certainly worthy of the consideration of all, not the least important being that ridiculous cheapness and high quality are not to be expected together. There can be no doubt that the introduction of solid emery wheels into this country has been much impeded by the low quality of goods offered by English makers, and for this manufacturers and users are equally blameworthy, for the latter, being ever too ready to buy the lowest priced article offered, really encourage producers to make quality quite a secondary consideration. In America, on the contrary, first cost in the machine tools is scarcely thought of, provided the quality and utility are the highest attainable, and hence it is that the Tanite Company are enabled to say with regard to the use of the solid emery wheel that it is a labour-saving process which is scarcely yet introduced into this country, and which seems to be recognised here as an American institution, and to add that, ignorant as to where the process had its birth, and admitting that many European countries have made independent progress in this branch, they nevertheless do themselves claim that it is distinctively American. Certainly its greatest success has been in America; the largest sales are there, and necessarily the American makers of this class of goods have the widest experience both as the make and the uses of solid wheels.

Lower price, it is remarked, is the only claim to pre-eminence of which European goods can boast, and the Tanite Company admit that for years their manufactures have commanded a higher price than all others, but that success has gone hand-in-hand with the price. All that seems necessary is that the user should buy wheels suited to the purposes for which he intends to apply them, introduce them on a liberal scale, candidly consult with the makers of whom they buy, and see that the foremen and workmen give fair play to the new tools; it will then be ascertained that grinding by the use of the solid wheels is a process destined to revolutionise many branches of wood and metal manufacture. At the recent Centennial Exhibition the application of a revolving emery wheel at high velocity for grinding metallic surfaces attracted much attention from Europeans, and it was remarked that so large an amount of thought and ingenuity has been brought to bear upon them that the chisel and the file are in danger of elimination from the workshop for the majority of purposes for which they are now employed. This can readily be conceived from the fact that the proprietor of an Austrian factory, employed on the small work of gun and pistol locks, was enabled by the introduction of six machines in his factory to dispense with the labour of 70 men. The file in the hands of an expert workman may travel about 60 ft. per minute; the solid wheel travels 5500 ft. per minute, and it is pointed out that the cutting points of the file are steel, but they have to cut on steel and chilled edges almost equally hard, whilst the cutting points of the solid wheel are emery, which is harder than any metal: in fact, diamond only will cut the solid wheel. Again, whilst files are broken, mislaid, or stolen by the dozen without fear of detection, the solid wheel once suitably mounted is always at hand, and ever ready for work; for as it is very truly said, he who equips his factory with suitably mounted solid emery wheels yokes a steam-engine to his files instead of men.

Emery, as most readers of the *Mining Journal* will know, is found in few places, although a natural rock; the almost only source of supply, commercially speaking, being Naxos, in Greece, the principal quarries being at Ephesus, and the name being taken from Cape Emeri, where it occurs. It is a peculiar compound of alumina and iron, and is a massive granular or compact variety of corundum more or less impure—a kind of inferior gem sapphire, its cutting and grinding properties being due rather to its crystalline structure than to its actual hardness, which is much below that of corundum, the smooth facets of which make it of less value for similar purposes. The rock is converted into grain or commercial emery by being crushed, cleaned, sifted, and sorted according to its size. The emery grain has long been in use, discs of wood covered with leather being smeared with glue, and then rolled in emery till they took up as much as would stick to them. These wheels are widely used, and for mere polishing will probably never be superseded, as their ability to yield under pressure, due to the pliancy of the leather, gives them advantages not to be found in the solid wheel. But for grinding, shaping, fettling, and the mere removal of metal, the solid wheels possess innumerable advantages. Solid wheels are made by compounding the emery grain with some cohesive substance, and moulding the mass into the desired shape. As part of the economy of these wheels results from their extraordinary speed (a mile a minute for a point on the face of the wheel) they must be evenly balanced, of uniform density, and able to withstand the disrupting agency of the centrifugal force. As they will eventually be worn to dust, the material must be uninjurious to the health. As they will be exposed to severe friction, they must be able to withstand high heat, and they should also be free from all offensive smell. The cohesive material should also be pliable enough to let the emery drop out when its work is done, and should not be of such character as to be injurious in its effects upon the metal to be ground. It will thus be readily understood that the value of solid emery wheels depends in a great measure upon the character of the material with which the particles of emery are agglomerated, and it is claimed that tanite, which is manufactured by secret processes from waste products, affords a thoroughly satisfactory and reliable base for the emery in forming the solid wheel, and the Tanite Company also claim that, besides the special adaptability of base tanite, the chemical and mechanical processes in their factory have attained such perfection that the uniformity of their goods alone warrants them in asking, and the public in paying, that high price which tanite goods have always commanded; nay, more, they assert that their experience in the application of these goods is so wide and varied that the success attained by buying persistently of them far more than compensates for the apparent saving made in the purchase of low-priced but inferior goods.

It should be further mentioned that the rapid introduction of solid emery wheels has been largely due to the manufacture of special machines wherewith to apply them, and that though the Tanite Company was the first emery wheel company to start this industry, many prominent firms have devised such special machinery, either for sale or for their own use. Mounted on simple, compact, and solid, though cheap machines, these wheels may stand with advantage in every room of every factory where wood or metals are worked; either to take effective part in such working, or to keep in constant and thorough order the tools with which such work is done. Their simplest use is in the mere removal of metal, as where castings, rough from the foundry sand, have their gates, fins, and sprues ground off. Their next use is the fitting of castings, a use better exemplified by the American stove manufacture, which now not only produces kitchen stoves and ranges whose covers and doors are fitted with almost mechanical perfection, but has brought into fashion stoves surrounded with mica lights both above the fire and below the grate, so fitted as to be gas-tight and dust-tight, though composed of hundreds of small pieces. But their use for fitting does not end with castings, either of brass or iron, though they exemplify here their immense advantage as file and labour savers. Those who do not want to save files and labour can do the work with files. In the cast-steel plough manufacture of the Western States is shown a species of work which cannot be done by the file. Here chemical and mechanical skill has exhausted itself in the effort to produce the hardest form of steel, and shears and mould boards are produced of such shape as to defy successful working in the lathe or planer, and of such hardness that a file will scarcely touch them. To fit them single factories use tons of solid emery wheels every year. We are here brought, out of turn, to comment on the power which these wheels give us to cheaply and easily use metal so hard as to be otherwise unworkable. By the use of suitable machinery to apply the wheels with the hardened dies used in the manufacture of hexagon and other nuts, and all similar dies, can be kept in constant order. As a result of their hardness such dies are always brittle, and when the sharp cutting edges fray off planing them down steel tools would be so expensive as to be long delayed, during which delay grooved, jagged, and serrated pieces would be roughly chopped out, instead of blanks so smooth and perfect as scarcely to require the subsequent process of milling or grinding. By taking advantage of this power due to tanite wheels scrap iron can often be substituted with advantage where a first quality of metal would be needed on account of its softness were ordinary steel tools used to work it. The peculiar property of an emery wheel as compared with a steel tool is well illustrated by the use of such wheels to break through the scale of castings before putting them in the lathe. The edges and corners of light pulleys, for instance, are often so chilled as to be nearly as hard as glass. A well-sharpened lathe tool would be ruined in the attempt to break through such a scale. A tanite wheel, on the other hand, would grind off the whole corner of the pulley, when the tool could be safely entered without destroying its edge.

Judging from the results obtained in America, there appears to be every justification for assuming that the claim to enormous economy for solid emery wheels as compared with files, unless in very exceptional cases, is well founded, and their adoption as labour-saving machines, especially at a time like the present, when the persistent demands of workmen to maintain wages at a rate which, in the present condition of commercial affairs, is driving the whole business of the country elsewhere, would seem to be most desirable. The first cost of the machines is not large, and if manufacturers can succeed by their use in enabling their workmen to turn out twice the quantity of work with the same amount of labour, and at the same price, it may be possible to continue the present scale of payment, and yet send their manufacture into the market at a price that will command purchasers.

ROCK-DRILLING MACHINERY.

Several inventions have recently been patented for improvements in rock-drills, one of the most peculiar being that of Messrs. KENNEDY and EASTWOOD, of Ulverston, who propose a new arrangement for that class of rock-drilling machinery, the action of which consists in a combined percussive and rotatory movement imparted to the drill either manually or automatically. The apparatus is mounted upon an oblong frame or saddle, and comprises a cylinder sliding in guides upon the saddle, and within which a piston is reciprocated by means of steam, compressed-air, or other suitable motive-power. The drill or jumper is fixed to one end of the piston-rod or ram, the feeding screw entering at the other end and engaging with a nut formed in the piston-rod or upon a sleeve attached thereto, so that as the piston and piston-rod are turned the cylinder and its contents and attachments are caused to advance or retire towards or from the face of the work, thus feeding or withdrawing the drill as desired.

The mechanism whereby the said feeding is automatically performed consists of a collar or disc secured upon the piston-rod, and working in a corresponding, but by preference cylindrical, guide or sleeve attached to or forming part of the sliding cylinder; a groove formed in the periphery of the said collar engages with a stud projecting through an oblong slot in the side of the cylindrical guide or sleeve, and attached to a sliding bar and block, the axis of which is parallel to that of the piston-rod; a similar stud projects upwards from another part of sliding block, and engages with a peculiarly formed zig-zag like cam slot formed in a roller, by preference situated above the said sliding block. This roller is supported in bearings, and is provided at one of its ends with a bevel wheel gearing with a similar wheel fixed to a shaft lying at right angles to the roller, and carrying a worm or tangent screw, which gears with a worm wheel fixed upon the piston-rod or upon a sleeve attached thereto. The effect of this arrangement is that as the piston is reciprocated, in the cylinder the grooved collar or disc causes the sliding block to be also reciprocated, and the stud or pin traversing the zig-zag like slot in the roller causes the said roller to rotate slowly and intermittently, the rotation being in turn transferred to the piston-rod and drill through the gearing already referred to, or by other suitable gearing. The reciprocation of the grooved collar or plunger is also utilised to work the slide valve on the cylinder by causing it to engage with a double pawl lever in connection with the valve spindle. When the limit of the feed has been reached the sliding cylinder may be run back again by removing a split or linch pin, whereby the feed screw is held fixed and actuating the screw by a handle provided for the purpose; and when desired the drill may also be fed and rotated manually by a handle placed upon the worm or tangent screw, shaft, or other convenient gear spindle.

For rocks or minerals of different degrees of hardness feed screws of different pitch may be employed, the apparatus being constructed with a view to their easy removal and substitution. The drill may be pointed in any direction by the employment of a turntable-like disc secured by bolts above the ordinary clamp which embraces the supporting column, and in addition they use a steadying bar which fits into a socket in the saddle, and is adjusted against the face of the work, a trussing pressure being applied through a pinching pin and centre at the end thereof.

A modification of Abegg's hand drill, described some years since in the *Mining Journal*, has been patented by Mr. JAMES MAWSON, of Eldon, Durham. An iron or other rod with a screw thread formed upon it is mounted in a movable bearing so as to be capable of working therein, and in one end of which screwed rod the drill or boring tool is fixed. The movable bearing in which the rod works is provided with a suitable axis, and is constructed in two parts, the upper part being hinged to the lower, and secured thereto by means of a thumb screw, and is provided with a collar likewise in two parts, and tapped to correspond with the screw thread on the drill rod. The lower half of the screwed collar is dovetailed or otherwise secured to the bottom half of the movable bearing, and the upper half of the former is secured to the upper half of the latter by means of a screw which passes through the top of the bearing into the collar so as to allow the latter to be readily removed for repair. Upon one or both ends of the drill rod, which is or are suitably squared for that purpose, ratchet braces are placed in order to give the necessary motion for drilling. The ratchet braces are constructed with a double ratchet wheel—that is to say, instead of the ratchet wheel having the whole of its teeth set one way it is divided longitudinally, one half having its teeth set one way and the other half the other way, and into each set of teeth a separate pawl or catch attached to the lower end of the lever or handle of the brace fits, one catch being on one side of the lower end of the lever or handle of the brace, and the other on the opposite side thereof, and each provided with a spring in the usual manner. In order to admit of one only of the catches or pawls acting upon the ratchet wheel at a time a set screw is passed through each side of the lower end of the lever or handle, and the ends of which set screws bear upon the pawls or catches, thus when the ratchet is in use one pawl is acting upon one set of teeth, when it is desired to reverse the action of the ratchet, the set screw in connection with the pawl at present acting upon the ratchet is screwed so as to press the pawl out of gear, and at the same time that in connection with the other pawl is withdrawn, the spring then bringing the latter to bear upon the ratchet, thus giving a reverse motion thereto.

When it is desired to put the machine in action the drill rod is placed in the lower half of the movable bearing, and the upper half closed thereon and fastened with the thumb screws. The movable bearing is then placed in the frame or support of the machine, which is constructed of two plates of iron having suitable notches cut in one edge thereof for the reception of the axis of the movable bearing, and which two plates are connected at both ends by means of cross bars, through the upper of which a set screw with a pointed end works, the lower cross bar being provided with a pointed pin, and by means of which set screw and pin the frame or support is fixed to the top and bottom of the gallery or drift in which it is desired to work. When the movable bearing with the rod having its drill or boring tool and ratchet brace or braces attached thereto is so mounted as to be capable of turning in the notches of the frame to any desired angle, the drill or boring tool is placed in the desired position, and the requiste rotary and forward motion given thereto by means of ratchet braces. When it is desired to withdraw the drill or boring tool the motion of the ratchet is reversed, as hereinbefore described. In order to allow the drill to be used vertically the axis of the movable bearing is not placed in the notches, as before mentioned, but are supported by two plates of metal having suitable holes formed therein for the purpose, and which are are attached to the frame by means of bolts or screws, and are adjustable to any desired height. It will be understood that when the machine is working in the open—that is to say, not in a gallery or drift—the frame or support must be provided with a stay or leg, and the set screw at the top may be dispensed with.

IMPROVEMENTS IN ROCK-DRILLS.

The machines to which the invention of Mr. W. W. DUNN, of San Francisco, relates are of that class wherein the drill is moved to and fro, and turned on its axis by a piston with a reciprocating and turning motion within a cylinder supplied with air or steam, directed alternately into both ends of the cylinder through the agency of a suitable valve. The slide valve and ports are so formed and arranged that the valve slides to and fro transversely across the cylinder instead of longitudinally with the same. Motion is given by a rocking shaft and arms arranged above the cylinder. This rocking shaft has on it an arm which connects with the slide valve and two other arms, which are arranged to be acted upon by a conical protuberence on the piston-rod in such manner that the latter by its to and fro movement imparts a rocking motion to the said shaft, and thereby produces the required to and fro motion of the slide valve across the port face of the cylinder; but although he prefers this arrangement of the valve to move across the cylinder instead of longitudinally with the axis of the same he sometimes modifies this part of the invention by arranging the said valve to move in a longitudinal direction upon the cylinder, and operates the same by two rocking arms carried on suitable shafts which have other arms arranged to be acted upon by the aforesaid conical protuberance on the piston-rod. The said rocking shafts are passed through packing boxes filled with hemp or other packing to prevent their jarring or vibrating during the operation of the machine. For advancing the drill the feed screw is arranged at the side of the cylinder and passes through a feed nut attached to the same. Parallel with the piston-rod he arranges another rocking shaft, which has on it two arms arranged to be actuated by opposite sides of the aforesaid conical piece on the piston-rod, so as to produce the required rocking or vibrating motion of the said shaft. The said shaft also has another arm, to which are pivotted two pawls that take into the teeth or a ratchet wheel on the feed screws, the points of these pawls are formed to act upon the ratchet wheel in opposite directions, so that one pushes and the other pulls the ratchet wheel around in the same direction, and the drill, therefore, has a continuous feeding or advance motion during the operation of the machine. When the feed mechanism is to be operated by hand he provides the end of the feed screw with a hand lever, and he provides a sounder, which acts when the feed is not fast enough. This sounder consists of a small lever pivotted on the cylinder frame, and which has a spring to bring it into contact with the cones on the piston-rod; at or near the front of the machine he places a small stud which is struck by the sounder lever when the feed requires to be accelerated, and causes the lever to indicate the need of acceleration by the tapping sound produced by the vibrating of the said lever.

The mechanism for causing the rotation of the piston-rod with the drill is also novel. For this purpose Mr. Dunn forms the head at the rear end of the cylinder with a deep cavity or recess for the reception of a ratchet wheel and devices for controlling the same. Two pawls are arranged to take into this wheel at points diametrically opposite each other. They are formed with bosses which drop into suitable cavities, and they are kept in place by stop pieces cast in the head. The springs of these pawls are held by a small tooth formed and fitted into a notch in studs fixed in the head or cover. By this construction and arrangement of the parts he avoids all screws and similar fastenings for securing these parts in place. The ratchet wheel has a central square hole through which a rod is passed; this rod does not project at the rear through the cylinder cover, but extends forward into the piston-rod, which is made hollow for a portion of its length to receive this square rod and slide to and fro over it. The said square rod has a head at the back or inner side of the ratchet wheel, its part which extends inside the piston rod is twisted or made spiral, and the piston-rod has a steel bush with a correspondingly formed aperture which fits the spiral rod. The head or cover has a plate placed over the the recess or cavity enclosing the ratchet wheel, and which is secured to the head by bolts and nuts. The said spiral rod extends through this plate into the piston-rod. The effect of the spiral or twisted rod in combination with the ratchet wheel and pawl is that during the forward stroke or motion of the piston no rotation of the same is produced, but during the backward stroke or movement of the piston the same and the drill or perforating implement are turned on their axis a distance equal to one tooth of the said wheel, so that the said drill does not strike two blows in succession in exactly the same place.

For securing the drill in the end of the piston-rod he forms an aperture near the end of the rod, in which he fits a piece termed a "die," which bears on the shank of the drill. Over the end of the piston-rod he fits a collar, and at the side of the rod opposite the said die he drives a key between the said collar and rod, thereby causing the die to bind tightly on the drill shank or stem.

According to another part of his invention Mr. Dunn provides the means for automatically stopping a machine when the drill has been fed forward to the full extent of the feed screw. For this purpose he provides the supply pipe or passage of the engine with a throttle-valve, which has outside of the said pipe or passage on its axis or rod a lever arm or crank. This lever arm or crank is arranged in such a position in relation to a fixed cam or projection on the forward of the cylinder frame that the said arm or crank will, when the drill has been fed forward to its full extent, act on the said lever arm or crank to close the said valve, thereby cutting off the supply of the steam or other actuating fluid and stopping the machine. Another part of his invention relates to the construction of the supporting stands or frames for rock-drilling machines. He constructs one of his improved stands in the form of frame with three short adjustable legs. This stand has a round cross bar, on which he mounts a clamp provided with a pinching screw. This clamp is formed with a conical socket for the reception of a conical trunnion on the cylinder. And he thus supports the said cylinder and its adjuncts on a universal joint, whereby the machine can be adjusted to work at any desired angle and in any required vertical plane.

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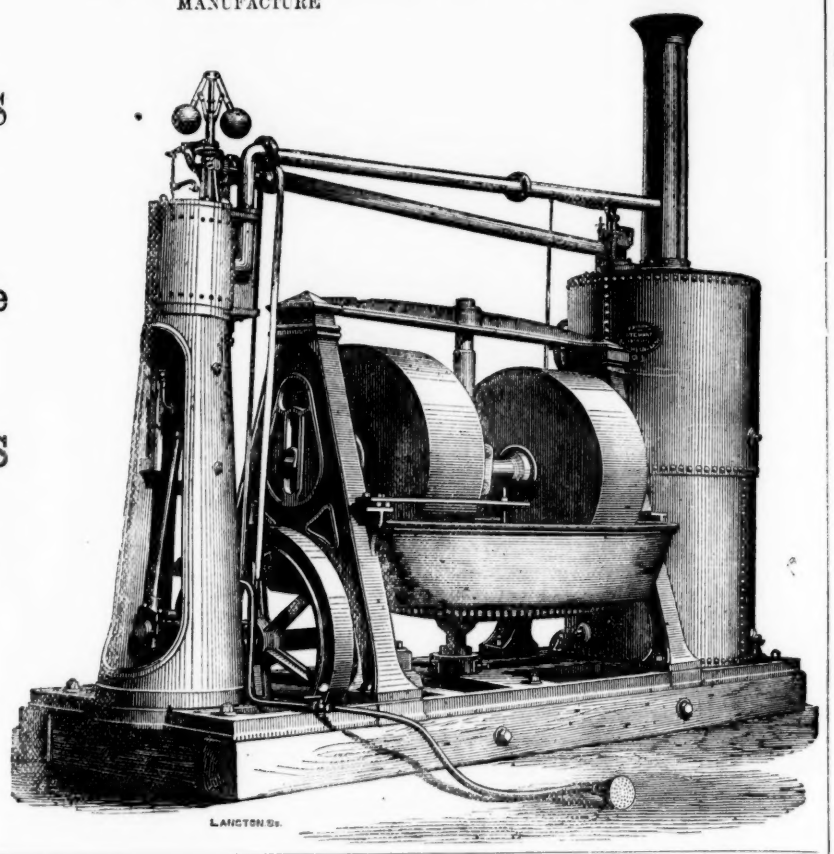

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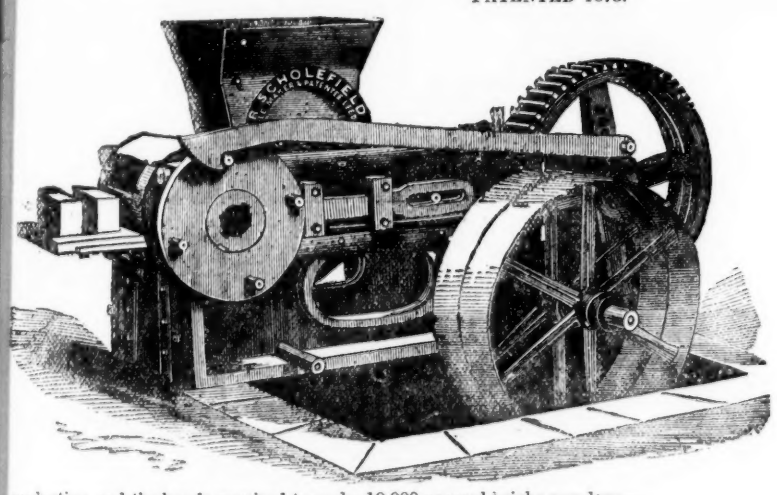

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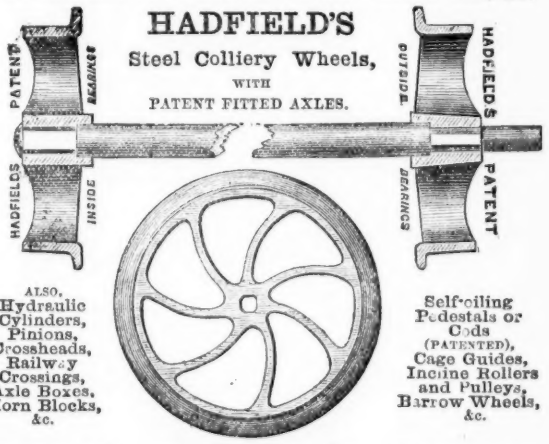

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duction, but that he has freely availed himself of the assistance of others, when that assistance was likely to render it more useful.

SOLID EMERY WHEELS.

For some years past the solid emery wheels of the Tanite Company of Stroudsburg, Pennsylvania, have enjoyed a high reputation in America, and have now come to be regarded as an indispensable portion of the machine-tool plant in every large workshop, so that it is not surprising that it should now be proposed to introduce them extensively into this country. Many of the statements made are certainly worthy of the consideration of all, not the least important being that ridiculous cheapness and high quality are not to be expected together. There can be no doubt that the introduction of solid emery wheels into this country has been much impeded by the low quality of goods offered by English makers, and for this manufacturers and users are equally blameworthy, for the latter, being ever too ready to buy the lowest priced article offered, really encourage producers to make quality quite a secondary consideration. In America, on the contrary, first cost in the machine tools is scarcely thought of, provided the quality and utility are the highest attainable, and hence it is that the Tanite Company are enabled to say with regard to the use of the solid emery wheel that it is a labour-saving process which is scarcely yet introduced into this country, and which seems to be recognised here as an American institution, and to add that, ignorant as to where the process had its birth, and admitting that many European countries have made independent progress in this branch, they nevertheless do themselves claim that it is distinctively American. Certainly its greatest success has been in America; the largest sales are there, and necessarily the American makers of this class of goods have the widest experience both as the make and the uses of solid wheels.

Lower price, it is remarked, is the only claim to pre-eminence of which European goods can boast, and the Tanite Company admit that for years their manufactures have commanded a higher price than all others, but that success has gone hand-in-hand with the price. All that seems necessary is that the user should buy wheels suited to the purposes for which he intends to apply them, introduce them on a liberal scale, candidly consult with the makers of whom they buy, and see that the foremen and workmen give fair play to the new tools; it will then be ascertained that grinding by the use of the solid wheels is a process destined to revolutionise many branches of wood and metal manufacture. At the recent Centennial Exhibition the application of a revolving emery wheel at high velocity for grinding metallic surfaces attracted much attention from Europeans, and it was remarked that so large an amount of thought and ingenuity has been brought to bear upon them that the chisel and the file are in danger of elimination from the workshop for the majority of purposes for which they are now employed. This can readily be conceived from the fact that the proprietor of an Austrian factory, employed on the small work of gun and pistol locks, was enabled by the introduction of six machines in his factory to dispense with the labour of 70 men. The file in the hands of an expert workman may travel about 60 ft. per minute; the solid wheel travels 5500 ft. per minute, and it is pointed out that the cutting points of the file are steel, but they have to cut on steel and chilled edges almost equally hard, whilst the cutting points of the solid wheel are emery, which is harder than any metal; in fact, diamond only will cut the solid wheel. Again, whilst files are broken, mislaid, or stolen by the dozen without fear of detection, the solid wheel once suitably mounted is always at hand, and ever ready for work; for as it is very truly said, he who equips his factory with suitably mounted solid emery wheels yokes a steam-engine to his files instead of men.

Emery, as most readers of the *Mining Journal* will know, is found in few places, although a natural rock; the almost only source of supply, commercially speaking, being Naxos, in Greece, the principal quarries being at Ephesus, and the name being taken from Cape Emeri, where it occurs. It is a peculiar compound of alumina and iron, and is a massive granular or compact variety of corundum more or less impure—a kind of inferior gem sapphire, its cutting and grinding properties being due rather to its crystalline structure than to its actual hardness, which is much below that of corundum, the smooth facets of which make it of less value for similar purposes. The rock is converted into grain or commercial emery by being crushed, cleaned, sifted, and sorted according to its size. The emery grain has long been in use, discs of wood covered with leather being smeared with glue, and then rolled in emery till they took up as much as would stick to them. These wheels are widely used, and for mere polishing will probably never be superseded, as their ability to yield under pressure, due to the pliancy of the leather, gives them advantages not to be found in the solid wheel. But for grinding, shaping, fettling, and the mere removal of metal, the solid wheels possess innumerable advantages. Solid wheels are made by compounding the emery grain with some cohesive substance, and moulding the mass into the desired shape. As part of the economy of these wheels results from their extraordinary speed (a mile a minute for a point on the face of the wheel) they must be evenly balanced, of uniform density, and able to withstand the disrupting agency of the centrifugal force. As they will eventually be worn to dust, the material must be uninjurious to the health. As they will be exposed to severe friction, they must be able to withstand high heat, and they should also be free from all offensive smell. The cohesive material should also be pliable enough to let the emery drop out when its work is done, and should not be of such character as to be injurious in its effects upon the metal to be ground. It will thus be readily understood that the value of solid emery wheels depends in a great measure upon the character of the material with which the particles of emery are agglomerated, and it is claimed that tanite, which is manufactured by secret processes from waste products, affords a thoroughly satisfactory and reliable base for the emery in forming the solid wheel, and the Tanite Company also claim that, besides the special adaptability of base tanite, the chemical and mechanical processes in their factory have attained such perfection that the uniformity of their goods alone warrants them in asking, and the public in paying, that high price which tanite goods have always commanded; nay, more, they assert that their experience in the application of these goods is so wide and varied that the success attained by buying persistently of them far more than compensates for the apparent saving made in the purchase of low-priced but inferior goods.

It should be further mentioned that the rapid introduction of solid emery wheels has been largely due to the manufacture of special machines wherewith to apply them, and that though the Tanite Company was the first emery wheel company to start this industry, many prominent firms have devised such special machinery, either for sale or for their own use. Mounted on simple, compact, and solid, though cheap machines, these wheels may stand with advantage in every room of every factory where wood or metals are worked; either to take effective part in such working, or to keep in constant and thorough order the tools with which such work is done. Their simplest use is in the mere removal of metal, as where castings, rough from the foundry sand, have their gates, fins, and sprues ground off. Their next use is the fitting of castings, a use better exemplified by the American stove manufacture, which now not only produces kitchen stoves and ranges whose covers and doors are fitted with almost mechanical perfection, but has brought into fashion stoves surrounded with mica lights both above the fire and below the grate, so fitted as to be gas-tight and dust-tight, though composed of hundreds of small pieces. But their use for fitting does not end with castings, either of brass or iron, though they exemplify here their immense advantage as file and labour savers. Those who do not want to save files and labour can do the work with files. In the cast-steel plough manufacture of the Western States is shown a species of work which cannot be done by the file. Here chemical and mechanical skill has exhausted itself in the effort to produce the hardest form of steel, and shears and mould boards are produced of such shape as to defy successful working in the lathe or planer, and of such hardness that a file will scarcely touch them. To fit them single factories use tons of solid emery wheels every year. We are here brought, out of turn, to comment on the power which these wheels give us to cheaply and easily use metal so hard as to be otherwise unworkable. By the use of suitable machinery to apply the wheels with the hardened dies used in the manufacture of hexagon and other nuts, and all similar dies, can be kept in constant order. As a result of their hardness such dies are always brittle, and when the sharp cutting edges fray off planing them down steel tools would be so expensive as to be long delayed, during which delay grooved, jagged, and serrated pieces would be roughly chopped out, instead of blanks so smooth and perfect as scarcely to require the subsequent process of milling or grinding. By taking advantage of this power due to tanite wheels scrap iron can often be substituted with advantage where a first quality of metal would be needed on account of its softness were ordinary steel tools used to work it. The peculiar property of an emery wheel as compared with a steel tool is well illustrated by the use of such wheels to break through the scale of castings before putting them in the lathe. The edges and corners of light pulleys, for instance, are often so chilled as to be nearly as hard as glass. A well-sharpened lathe tool would be ruined in the attempt to break through such a scale. A tanite wheel, on the other hand, would grind off the whole corner of the pulley, when the tool could be safely entered without destroying its edge.

Judging from the results obtained in America, there appears to be every justification for assuming that the claim to enormous economy for solid emery wheels as compared with files, unless in very exceptional cases, is well founded, and their adoption as labour-saving machines, especially at a time like the present, when the persistent demands of workmen to maintain wages at a rate which, in the present condition of commercial affairs, is driving the whole business of the country elsewhere, would seem to be most desirable. The first cost of the machines is not large, and if manufacturers can succeed by their use in enabling their workmen to turn out twice the quantity of work with the same amount of labour, and at the same price, it may be possible to continue the present scale of payment, and yet send their manufacture into the market at a price that will command purchasers.

ROCK-DRILLING MACHINERY.

Several inventions have recently been patented for improvements in rock-drills, one of the most peculiar being that of Messrs. KENNEDY and EASTWOOD, of Ulverston, who propose a new arrangement for that class of rock-drilling machinery, the action of which consists in a combined percussive and rotatory movement imparted to the drill either manually or automatically. The apparatus is mounted upon an oblong frame or saddle, and comprises a cylinder sliding in guides upon the saddle, and within which a piston is reciprocated by means of steam, compressed-air, or other suitable motive-power. The drill or jumper is fixed to one end of the piston-rod or ram, the feeding screw entering at the other end and engaging with a nut formed in the piston-rod or upon a sleeve attached thereto, so that as the piston and piston-rod are turned the cylinder and its contents and attachments are caused to advance or retire towards or from the face of the work, thus feeding or withdrawing the drill as desired.

The mechanism whereby the said feeding is automatically performed consists of a collar or disc secured upon the piston-rod, and working in a corresponding, but by preference cylindrical, guide or sleeve attached to or forming part of the sliding cylinder; a groove formed in the periphery of the said collar engages with a stud projecting through an oblong slot in the side of the cylindrical guide or sleeve, and attached to a sliding bar and block, the axis of which is parallel to that of the piston-rod; a similar stud projects upwards from another part of sliding block, and engages with a peculiarly formed zig-zag like cam slot formed in a roller, by preference situated above the said sliding block. This roller is supported in bearings, and is provided at one of its ends with a bevel wheel gearing with a similar wheel fixed to a shaft lying at right angles to the roller, and carrying a worm or tangent screw, which gears with a worm wheel fixed upon the piston-rod or upon a sleeve attached thereto. The effect of this arrangement is that as the piston is reciprocated, in the cylinder the grooved collar or disc causes the sliding block to be also reciprocated, and the stud or pin traversing the zig-zag like slot in the roller causes the said roller to rotate slowly and intermittently, the rotation being in turn transferred to the piston-rod and drill through the gearing already referred to, or by other suitable gearing. The reciprocation of the grooved collar or plunger is also utilised to work the slide valve on the cylinder by causing it to engage with a double pawl lever in connection with the valve spindle. When the limit of the feed has been reached the sliding cylinder may be run back again by removing a split or linch pin, whereby the feed screw is held fixed and actuating the screw by a handle provided for the purpose; and when desired the drill may also be fed and rotated manually by a handle placed upon the worm or tangent screw, shaft, or other convenient gear spindle.

For rocks or minerals of different degrees of hardness feed screws of different pitch may be employed, the apparatus being constructed with a view to their easy removal and substitution. The drill may be pointed in any direction by the employment of a turntable-like disc secured by bolts above the ordinary clamp which embraces the supporting column, and in addition they use a steadying bar which fits into a socket in the saddle, and is adjusted against the face of the work, a trussing pressure being applied through a pinching pin and centre at the end thereof.

A modification of Abegg's hand drill, described some years since in the *Mining Journal*, has been patented by Mr. JAMES MAWSON, of Eldon, Durham. An iron or other rod with a screw thread formed upon it is mounted in a movable bearing so as to be capable of working therein, and in one end of which screwed rod the drill or boring tool is fixed. The movable bearing in which the rod works is provided with a suitable axis, and is constructed in two parts, the upper part being hinged to the lower, and secured thereto by means of a thumb screw, and is provided with a collar likewise in two parts, and tapped to correspond with the screw thread on the drill rod. The lower half of the screwed collar is dovetailed or otherwise secured to the bottom half of the movable bearing, and the upper half of the former is secured to the upper half of the latter by means of a screw which passes through the top of the bearing into the collar so as to allow the latter to be readily removed for repair. Upon one or both ends of the drill rod, which is or are suitably squared for that purpose, ratchet braces are placed in order to give the necessary motion for drilling. The ratchet braces are constructed with a double ratchet wheel—that is to say, instead of the ratchet wheel having the whole of its teeth set one way it is divided longitudinally, one half having its teeth set one way and the other half the other way, and into each set of teeth a separate pawl or catch attached to the lower end of the lever or handle of the brace fits, one catch being on one side of the lower end of the lever or handle of the brace, and the other on the opposite side thereof, and each provided with a spring in the usual manner. In order to admit of one only of the catches or pawls acting upon the ratchet wheel at a time a set screw is passed through each side of the lower end of the lever or handle, and the ends of which set screws bear upon the pawls or catches, thus when the ratchet is in use one pawl is acting upon one set of teeth, when it is desired to reverse the action of the ratchet, the set screw in connection with the pawl at present acting upon the ratchet is screwed so as to press the pawl out of gear, and at the same time that in connection with the other pawl is withdrawn, the spring then bringing the latter to bear upon the ratchet, thus giving a reverse motion thereto.

When it is desired to put the machine in action the drill rod is placed in the lower half of the movable bearing, and the upper half closed thereon and fastened with the thumb screws. The movable bearing is then placed in the frame or support of the machine, which is constructed of two plates of iron having suitable notches cut in one edge thereof for the reception of the axis of the movable bearing, and which two plates are connected at both ends by means of cross bars, through the upper of which a set screw with a pointed end works, the lower cross bar being provided with a pointed pin, and by means of which set screw and pin the frame or support is fixed to the top and bottom of the gallery or drift in which it is desired to work. When the movable bearing with the rod having its drill or boring tool and ratchet brace or braces attached thereto is so mounted as to be capable of turning in the notches of the frame to any desired angle, the drill or boring tool is placed in the desired position, and the requisite rotary and forward motion given thereto by means of ratchet braces. When it is desired to withdraw the drill or boring tool the motion of the ratchet is reversed, as hereinbefore described. In order to allow the drill to be used vertically the axis of the movable bearing is not placed in the notches as before mentioned, but are supported by two plates of metal having suitable holes formed therein for the purpose, and which are are attached to the frame by means of bolts or screws, and are adjustable to any desired height. It will be understood that when the machine is working in the open—that is to say, not in a gallery or drift—the frame or support must be provided with a stay or leg, and the set screw at the top may be dispensed with.

IMPROVEMENTS IN ROCK-DRILLS.

The machines to which the invention of Mr. W. W. DUNN, of San Francisco, relates are of that class wherein the drill is moved to and fro, and turned on its axis by a piston with a reciprocating and turning motion within a cylinder supplied with air or steam, directed alternately into both ends of the cylinder through the agency of a suitable valve. The slide valve and ports are so formed and arranged that the valve slides to and fro transversely across the cylinder instead of longitudinally with the same. Motion is given by a rocking shaft and arms arranged above the cylinder. This rocking shaft has on it an arm which connects with the slide valve and two other arms, which are arranged to be acted upon by a conical protuberence on the piston-rod in such manner that the latter by its to and fro movement imparts a rocking motion to the said shaft, and thereby produces the required to and fro motion of the slide valve across the port face of the cylinder; but although he prefers this arrangement of the valve to move across the cylinder instead of longitudinally with the axis of the same he sometimes modifies this part of the invention by arranging the said valve to move in a longitudinal direction upon the cylinder, and operates the same by two rocking arms carried on suitable shafts which have other arms arranged to be acted upon by the aforesaid conical protuberance on the piston-rod. The said rocking shafts are passed through packing boxes filled with hemp or other packing to prevent their jarring or vibrating during the operation of the machine. For advancing the drill the feed screw is arranged at the side of the cylinder and passes through a feed nut attached to the same. Parallel with the piston-rod he arranges another rocking shaft, which has on it two arms arranged to be actuated by opposite sides of the aforesaid conical piece on the piston-rod, so as to produce the required rocking or vibrating motion of the said shaft. The said shaft also has another arm, to which are pivoted two pawls that take into the teeth or a ratchet wheel on the feed screws, the points of these pawls are formed to act upon the ratchet wheel in opposite directions, so that one pushes and the other pulls the ratchet wheel around in the same direction, and the drill, therefore, has a continuous feeding or advance motion during the operation of the machine. When the feed mechanism is to be operated by hand he provides the end of the feed screw with a hand lever, and he provides a sounder, which acts when the feed is not fast enough. This sounder consists of a small lever pivotted on the cylinder frame, and which has a spring to bring it into contact with the cones on the piston-rod; at or near the front of the machine he places a small stud which is struck by the sounder lever when the feed requires to be accelerated, and causes the lever to indicate the need of acceleration by the tapping sound produced by the vibrating of the said lever.

The mechanism for causing the rotation of the piston-rod with the drill is also novel. For this purpose Mr. Dunn forms the head at the rear end of the cylinder with a deep cavity or recess for the reception of a ratchet wheel and devices for controlling the same. Two pawls are arranged to take into this wheel at points diametrically opposite each other. They are formed with bosses which drop into suitable cavities, and they are kept in place by stop pieces cast in the head. The springs of these pawls are held by a small tooth formed and fitted into a notch in studs fixed in the head or cover. By this construction and arrangement of the parts he avoids all screws and similar fastenings for securing these parts in place. The ratchet wheel has a central square hole through which a rod is passed; this rod does not project at the rear through the cylinder cover, but extends forward into the piston-rod, which is made hollow for a portion of its length to receive this square rod and slide to and fro over it. The said square rod has a head at the back or inner side of the ratchet wheel, its part which extends inside the piston rod is twisted or made spiral, and the piston-rod has a steel bush with a correspondingly formed aperture which fits the spiral rod. The head or cover has a plate placed over the the recess or cavity enclosing the ratchet wheel, and which is secured to the head by bolts and nuts. The said spiral rod extends through this plate into the piston-rod. The effect of the spiral or twisted rod in combination with the ratchet wheel and pawl is that during the forward stroke or motion of the piston no rotation of the same is produced, but during the backward stroke or movement of the piston the same and the drill or perforating implement are turned on their axis a distance equal to one tooth of the said wheel, so that the said drill does not strike two blows in succession in exactly the same place.

For securing the drill in the end of the piston-rod he forms an aperture near the end of the rod, in which he fits a piece termed a "die," which bears on the shank of the drill. Over the end of the piston-rod he fits a collar, and at the side of the rod opposite the said die he drives a key between the said collar and rod, thereby causing the die to bind tightly on the drill shank or stem.

According to another part of his invention Mr. Dunn provides the means for automatically stopping a machine when the drill has been fed forward to the full extent of the feed screw. For this purpose he provides the supply pipe or passage of the engine with a throttle-valve, which has outside of the said pipe or passage on its axis or rod a lever arm or crank. This lever arm or crank is arranged in such a position in relation to a fixed cam or projection on the forward of the cylinder frame that the said arm or crank will, when the drill has been fed forward to its full extent, act on the said lever arm or crank to close the said valve, thereby cutting off the supply of the steam or other actuating fluid and stopping the machine. Another part of his invention relates to the construction of the supporting stands or frames for rock-drilling machines. He constructs one of his improved stands in the form of frame with three short adjustable legs. This stand has a round cross bar, on which he mounts a clamp provided with a pinching screw. This clamp is formed with a conical socket for the reception of a conical trunnion on the cylinder. And he thus supports the said cylinder and its adjuncts on a universal joint, whereby the machine can be adjusted to work at any desired angle and in any required vertical plane.

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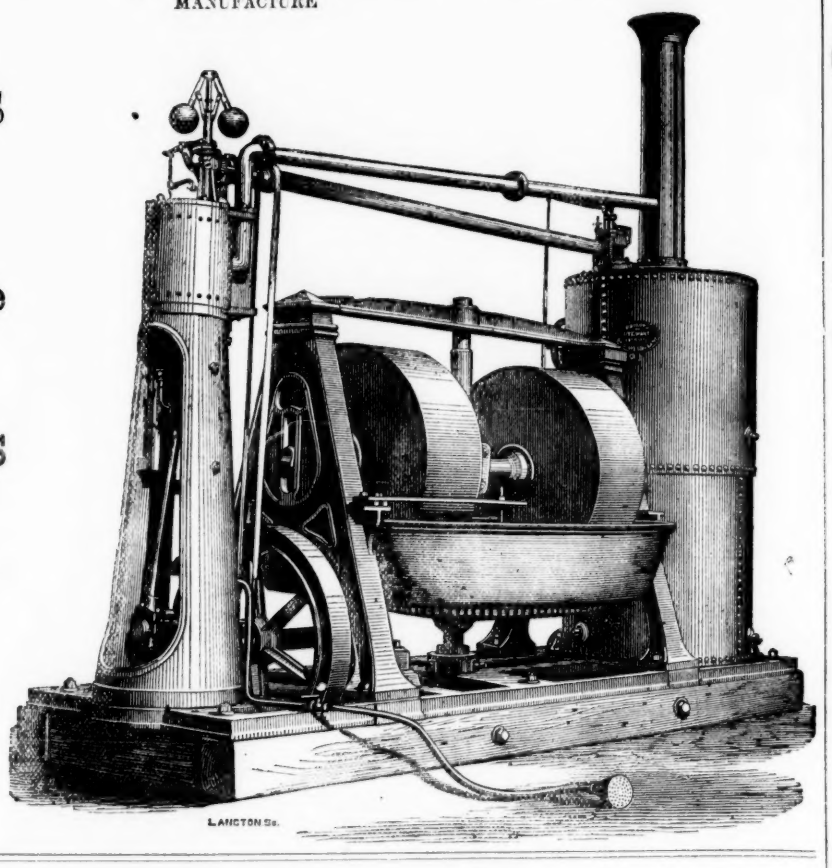

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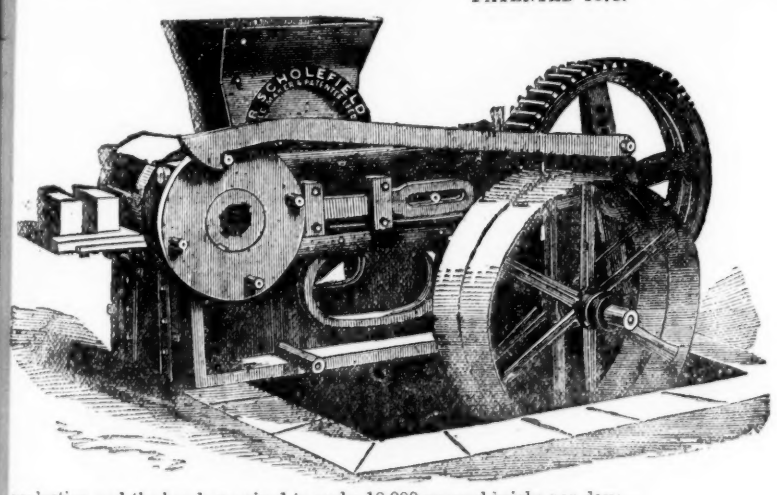

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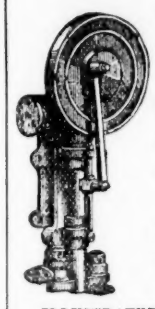

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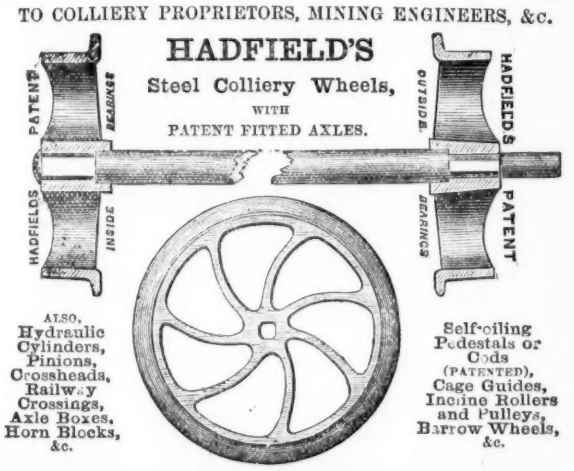

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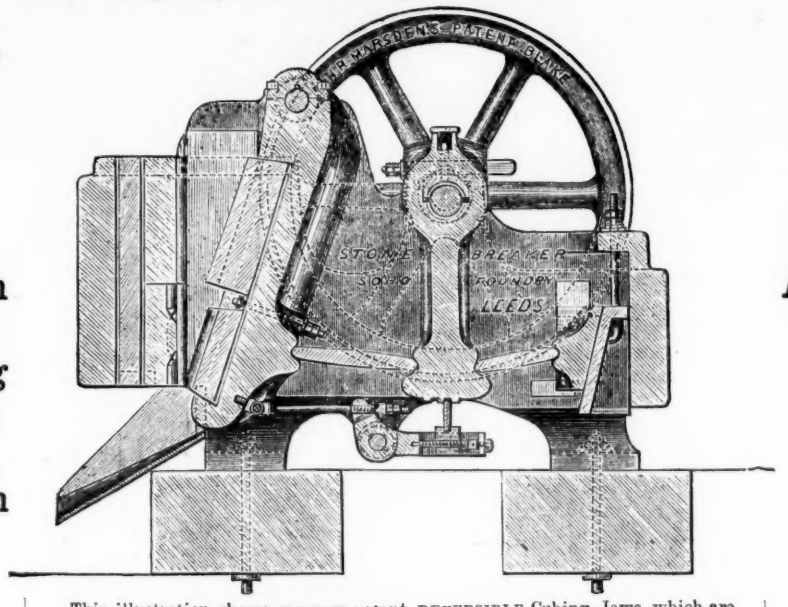

This illustration shows my new patent REVERSIBLE Cubing Jaws, which are made in upper and lower sections, and the backs planed, so that when the bottom part of the lower section becomes worn it can be turned upside down, and thus made equal to new. This process does not require the aid of skilled labour, the white metal being entirely dispensed with.

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"No Machine is equal to yours, combining as it does very great power, simplicity of construction, and cheapness."

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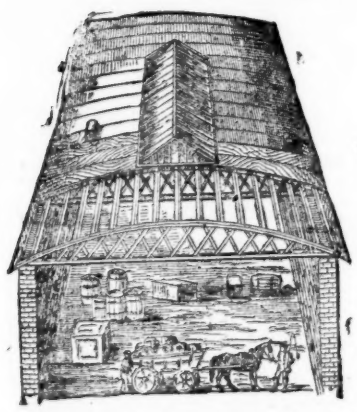

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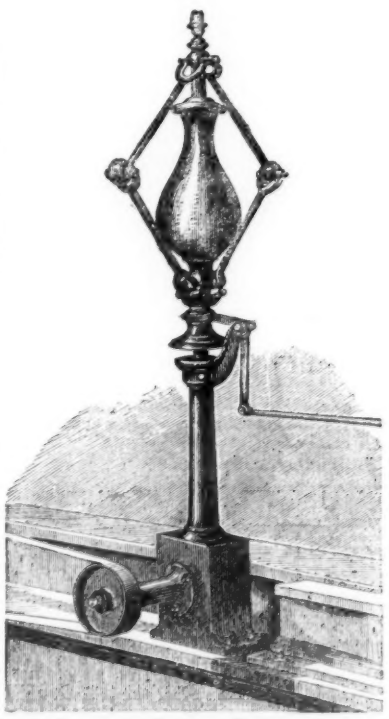

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